सी डैक
CDAC

Annual Report

2012-13

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

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Governing Council

(As on 31st March 2013)

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Secretary, Governing Council, C-DAC and
Registrar and Director (Legal & Contracts), C-DAC

Contents

Overview

The Year 2012-13 was the Silver Jubilee Year of C-DAC. Several technological achievements, events and recognitions marked this year as an important year in the history of C-DAC. On February 8, 2013, C-DAC became the first organization in the country to cross the half petaflop milestone with the launch of PARAM Yuva-II at the hands of Shri J. Satyanarayana, Secretary, DeitY. C-DAC also conducted two technology conclaves at Hyderabad and Delhi to showcase its competency in building technologies and solutions for various end-user agencies. During the year, C-DAC launched a number of flagship products including the launch of e-MSIPS at the hands of Shri Kapil Sibal, Hon'ble Minister for Communications & Information Technology (MCIT), Govt. of India. C-DAC also bagged several awards including the National Award for its Digital Programmable Hearing Aid product at the hands of His Excellency, The President of India, Shri Pranab Mukherjee.

One of the significant achievements of the past year was upgradation of the compute power of PARAM Yuva system from 54 TF/s to 529 TF/s. This also marked a transition from CPU-only architecture of the HPC systems to hybrid CPU and accelerator architecture for C-DAC. C-DAC also delivered several tools and applications for hybrid systems. In the area of Grid Computing, C-DAC added several tools for easy access and monitoring of the grid resources. In collaboration with the user community, several new applications were grid enabled. In the area of Cloud Computing, C-DAC launched its cloud platform, Meghdoot 1.0 during the Technology Conclave at Hyderabad in October 2012.

Continuing its contribution to overcome the language barrier in Computing and IT, C-DAC developed and enhanced several multilingual tools, technologies and products during this year. The consortia projects enabled stronger collaboration among various technology players of the country. These included the Cross-Lingual Information Access (CLIA) consortia, Indian Language Text-to-Speech Consortia, English to Indian Language Machine Translation (EILMT) consortia, and a consortia for Speech-to-Speech Machine Assisted Translation Dialogue System. A Centre of Excellence incubated for Marathi Language Computing was launched at the hands of Shri Prithviraj Chavan, Hon'ble Chief Minister of Maharashtra. The Centre of Excellence for Digital Preservation at C-DAC continued its endeavor to evolve standards, best practices and guidelines towards preservation of Indian heritage in digital form.

In the area of Professional Electronics, C-DAC completed the development of WiTrac (Wireless Traffic Controller) and made its first deployment this year. Few other technologies developed for Intelligent Transportation Systems include Electromagnetic Log to measure the speed of a ship, Vehicular Communication System (VCS), and a system to measure origin-destination statistics for correlation to traffic flow. Several electronic devices and associated solutions were also built for smart buildings. These include LED Luminaire, Human Occupancy Prediction System, and Indoor Air Quality Monitoring System. Synchronized Phasor Measurement Unit (SPMU), Object based Real Time Expert Systems Shell (ORTESS) and Autonomic Real Time Multi Protocol Gateway (ARTMG) are examples of a few systems developed in the area of Power Electronics. Some of the safety devices and solutions developed during the

year include Self Recording Image Surveillance System (SRISS), Distress Call Response Management System (DCRMS) and Portable Ultrasonic Landmine Sensor (PULS). Wider deployment of E-Vision and E-Nose systems was carried out during the year. Additionally, two medical electronics devices namely, Automatic Bio-Chemistry Analyzer (ABC Analyzer) and Wireless ECG Sensor were developed this year.

In the area of Software Technology, release of a new version of BOSS Linux operating system and its wider deployment were carried out during the year. Several e-Governance applications and frameworks including e-Praman with Aadhaar, State e-Governance Service Delivery Gateway (SSDG), Mobile Services Delivery Gateway (MSDG), and Electronic Project Proposal System (e-PPS) for DeitY and ICMR were developed/enhanced during the year. Some GIS enabled applications were also developed.

Enterprise-wide self-managed network solution - EDGE, a dynamic firewall solution - Chakra, a White-listing solution - AppSamvid, a URL analyzer are examples of a few security solutions developed during the year. Several solutions for authentication were also developed/enhanced. These include a fingerprint identification system, Iris recognition and identity solution, Face recognition system, and Online signature verification system. Several training and awareness initiatives were carried out in the area of Cyber Forensics for legal and law enforcement agencies.

In Health Informatics area, larger deployment of C-DAC's telemedicine solutions was carried out. Good progress was made towards development of Mercury Nimbus Suite that would enable deployment of EHR (Electronic Health Record) and Telemedicine services over cloud infrastructure. With the proliferation of mobile devices, C-DAC also initiated the development of health care services on mobile devices. m-Health and m-Swasthya are two such solutions. Various health care analysis tools were also developed. Medical image analyzer for cervical cancer prescreening, ECG analyzer for neurological disorder detection, and medical document semantic analyzer are few such examples.

With the formation of Academic Council and Academic Management Committee, C-DAC's Education and Training activities moved towards unification of the various courses offered by different C-DAC centres. Several e-Learning initiatives helped in conducting the education programs more effectively. Faculty development programs, national skill development programs and several capacity building initiatives also formed important components of this area during the year.

In addition to the activities carried out in various thematic areas, this year C-DAC also initiated some new technology development initiatives. These include testing and development of protocol for testing Aakash Tablet, Application development for Aakash Tablet, Electronic Personal Safety System, India Microprocessor and Government of India Search Engine.

The above mentioned activities during the year have resulted in several new collaborations with academic and research institutions both in India and abroad, several research publications and patents, and many awards.

This annual report covers the accomplishments and major activities of C-DAC during the year 2012-13.

Technical Areas

High Performance Computing (HPC), Grid Computing and Cloud Computing

C-DAC's HPC programme intends to provide a complete solution consisting of development of tools and technologies for HPC, Grid Computing and Cloud computing systems, development of applications for such systems and infrastructure, and provisioning of easy access to these resources to users across the country through National Knowledge Network (NKN). This is essentially aimed towards providing a platform for the researchers and domain experts to work towards addressing grand challenge problems and advancing fundamental science. In the description below, the activities carried out by C-DAC during the year 2012-13 in this area have been grouped into three categories – HPC, Grid Computing and Cloud Computing.

High Performance Computing (HPC)

HPC Systems, Tools and Technologies

PARAM Yuva-II at C-DAC, Pune

One of the significant achievements during the year was up-gradation of PARAM Yuva. The compute power of PARAM Yuva was upgraded to 529 TF/s from 54 TF/s. This was made possible through the use of Many Integrated Core (MIC) accelerator technology. The upgraded system uses approximately the same amount of electric power as its predecessor.

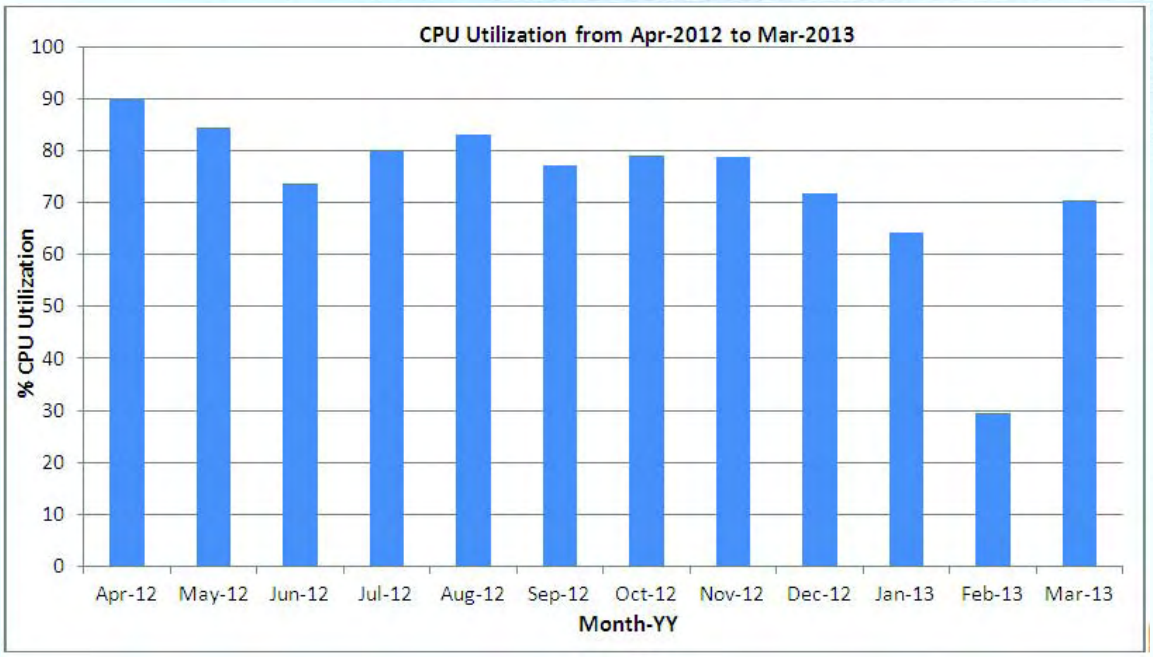
Shri J. Satyanarayana, Secretary, Department of Electronics and Information Technology (DeitY), Govt. of India launched PARAM Yuva-II at C-DAC Pune on 8th February 2013 and dedicated the new and powerful supercomputer to the HPC user community in the country. With this launch, C-DAC became the first organization in the country to have a supercomputer crossing the 500 TF milestone.

Shri J Satyanarayana launching the PARAM Yuva-II System

PARAM Yuva–II provides more than half a Petaflop of raw compute power using hybrid compute technology with compute co-processor and hardware accelerators. The cluster consists of 225 nodes, each having two 8-core Xeon processors and two Xeon Phi co-processors (each co-processor having 60 cores). By using such hybrid technology consisting of CPUs and compute co-processors, it was possible to retain the same electrical power usage, while improving the compute power, almost 10 fold.

The interconnection network comprises of home grown PARAMNet-III and Infiniband FDR System Area Network. PARAM Yuva–II has 200 Terabytes of high performance storage and support software for parallel computing. The system achieved a sustained performance of 386.71 Teraflop/s on High Performance Linpack (HPL) benchmark.

This system is designed to solve large and complex computational problems. This will provide an opportunity for new scientific endeavors for the research community. The earlier and upgraded PARAM Yuva systems at C-DAC are used extensively by the research community consisting of external and internal users. The usage statistics during the year is shown in the graph below.



Usage statics of PARAM Yuva at C-DAC, Pune

PARAMNet-III

PARAMNet-III is an indigenously developed high-performance interconnect for HPC clusters. It has been deployed at a number of national and international sites. During 2012-13, it was deployed in the HPC clusters commissioned by C-DAC at Vietnam Centre of Excellence in HPC, Hanoi, Vietnam and Kofi Annan India – Ghana Centre for Excellence in ICT, Accra, Ghana.

Reconfigurable Computing System (RCS)

The small form-factor, high performance FPGA based hardware accelerator cards developed by C-DAC consists of two components – RC hardware and the programming environment called Varada. During the year, 16 RC accelerator cards have been deployed at C-DAC, Bangalore, for use in accelerating cryptography based applications.

InClus: Integrated Clustering Solution (InClus)

InClus is Cluster management and monitoring software designed and developed by C-DAC. InClus addresses technical challenges in the field of HPC and makes cluster building easy. With the help of this software, one can easily install, manage and monitor HPC clusters. InClus helps end users to concentrate on their application/research work instead of troubleshooting and configuring clusters.

FPGA based accelerator card

Runtime Software for Hybrid System

A runtime software to support the execution of program across heterogeneous hardware accelerators, i.e GPU and FPGA, has been developed. The knowledge of StarPU runtime system is leveraged to schedule the program units (kernels) to run on GPU and/or FPGA. It includes farm of kernels which can each execute on different accelerators.

Hybrid Cluster Monitoring Tool

This tool can monitor not only the CPU cores, memory and other parameters of the system, but also the parameters of the GPU and FPGA, like health of cards, temperature and active engines.

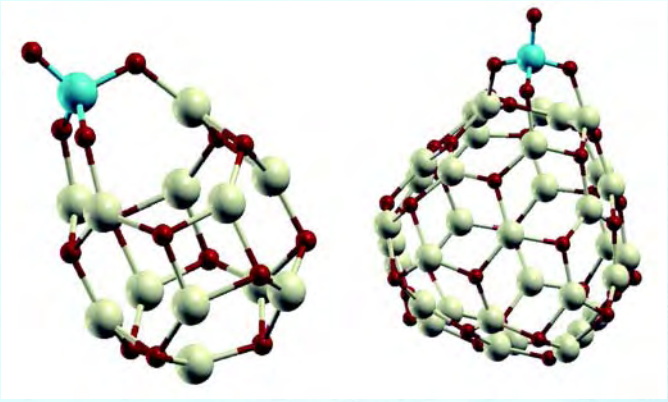
OpenCL Runtime Environment Generator

To program in OpenCL requires a programmer to first create and initialize the environment as well as write the kernel; this can be quite tedious for the programmer. This tool is intended to make OpenCL programming easy, as it automatically creates the runtime environment. It has support for multi kernel programs and image type.

HPC Applications

Electronic Structure Calculations of Manganese (Mn) Doped Zinc Oxide (ZnO) Clusters

ZnO is a technologically important semiconductor with variety of applications. Doping magnetic impurities like Mn not only induces magnetic moment in it, but also alters its electronic structure. This change is more pronounced at atomic scales, where the composition, shape, size and structure affect its properties. They provide new ground to understand doped nanostructures of ZnO and may also shed light on magnetism in Mn-doped ZnO thin films. This application is useful in prediction of novel structures of Mn doped ZnO nanoclusters. The application has been ported on PARAM Yuva system.



(a) *(b)*

Optimised structures of Manganese (Mn) doped Zinc Oxide (ZnO) clusters. The off-white , red and the blue balls represent, respectively, Zn, O and Mn atoms. In (a) Zn12MnO15 (b) Zn34MnO37 clusters are shown.

Evolutionary Algorithm Tools for Process Engineering, Bioinformatics and Chemo Informatics

Novel Algorithms from AI and Machine learning are increasingly being employed for solving problems in chemically reacting systems and chemo and bioinformatics. C-DAC initiated development of hybrid algorithms to combine tools like Support Vector Machines, Random Forest and Ant Colony optimization along with signal processing methodologies like wavelets and nonlinear dynamical theory to create a hybrid environment for solving a variety of problems in process engineering, Bioinformatics and Chemo-informatics. This application is useful in prediction of Mannose Binding Sites in Proteins employing SVM Classification, prediction of Galactose Binding Sites in Proteins employing SVM Classification, QSPR Prediction of Surface Tension of Organic Liquids using Support Vector Machine and Random Forest Regression etc.

Hybrid Cancer and Protein Function Prediction Tools

Broad patterns of gene expressions recorded using DNA microarray technology has helped in setting up massive data repositories, which may be used for further computational analysis and subsequent medical diagnosis.Similarly, varieties of descriptors such as topological, physico-chemical and geometrical can be extracted from molecules which may be subsequently presented to the algorithms as input vectors for building QSARs (quantitative structure activity relationship) for protein function prediction. C-DAC has developed tools for hybrid cancer and protein function prediction. These tools use Ant Colony Optimization with Support Vector Machines & Random Forests, Biogeography based Optimization with Support Vector Machines & Random Forests, Firefly Algorithms with SVM & RF, Group Search Algorithm with SVM & RF, Estimation of Distribution Algorithm with SVM & RF.

Anvaya – A Computational Workflow for High-Throughput Genome Analysis

Anvaya is a workflow environment that provides interface to frequently used Bioinformatics codes that run in serial as well as parallel mode i.e., MPI-based codes. Parallel mode thereby provides an edge over existing workflow software, which include only the serial implementations. This enable the capability to handle large volumes of data apart from decreasing the time of execution, as there is optimal use of high-end supercomputing clusters.

Anvaya software is available in a client-server mode across the Bioinformatics Resources & Applications Facility (BRAF) server. There are 13 pre-defined workflows available for various Bioinformatics analysis including NGS tools. The work describing Anvaya has been published in two international peer-reviewed journals viz., PlosOne and Journal of Bioinformatics and Computational Biology.

Whole Transcriptome Analysis

Whole transcriptome analysis (next generation sequencing) was used to unravel the effect of pre-operative progesterone in operable breast cancer. This work was done in collaboration with Tata Memorial Hospital, Mumbai. It involved RNA-seq analysis of breast cancer samples taken before and after treatment with progesterone. Differential expression of genes in both the conditions was analysed to explain the existing therapeutic response. This will help to understand the underlying genetic factors responsible for therapeutic response towards progesterone in breast cancer.

Whole Genome Phylogeny Problem Solving Environment (PSE)

With the availability of complete genome sequences in public domain databases, it has become possible to reconstruct phylogenies on the basis of much larger sets of data per species, allowing in principle a more reliable and representative inference of the tree of life. Genome trees are a means to capture and compare the overwhelming amount of information that is present in genomes. WGPhy is a problem-solving environment on HPC for computation of whole genome alignment and subsequent phylogeny using tools like MAUVE, Murasaki and RaxML.

Protein Structure Prediction Problem Solving Environment (PSE)

Protein Structure Prediction is one of the most challenging areas of research for the structural biologist. Out of few lakhs protein sequences only about nearly 88,000 have known structures. Protein Structure Prediction based on

Genetic Algorithm (GA) is an evolutionary technique based on the genetic principles of Crossover and Mutation. In GA-PSP, a random population is generated for building the molecules. A repeated computation is done for many generations and in each generation, Crossover and Mutation is performed. The molecules are built again and energy is evaluated at every step until it converges to minimum energy structure.

Portable Climate Forecast System (CFS) Model

Climate Forecast System is a large and complex scientific software used by the U.S. National Weather Service for Seasonal Forecasting purposes. The model is used for long range forecasting. The present version of the CFS model transferred to the Indian community was originally developed on the IBM HPC systems of NCEP, USA. As such the model has many IBM AIX specific architecture bindings. As the model has been developed and used by the limited group of scientists at a research setting, there is not enough documentation available for a typical user in the university environment with the commodity-off-the-shelf clusters.

The portable CFS model with performance optimization and enhanced usability, which is part of India's National Monsoon Mission Project (NMM) was deployed by C-DAC at Indian Institute of Tropical Meteorology (IITM), Pune. It involved porting and optimization of Climate Forecast System (CFS) v2 model on various Operating Systems (RHEL, CentOS) to make use of x86-64 architecture. The improvement in performance of CFS model has enabled early prediction of monsoon rainfall. Up-gradation of CFS and its existing modules, and Integration of new Earth system modules into CFS model has enhanced the accuracy and capability. Better usability has been achieved by development of web based Portal for execution and management of CFS model.

Nonlinear Analysis of Seismic Effects

Nonlinear analysis of seismic effects on buildings using high-performance computing (HPC) was done in collaboration with ICAD Moscow. Development of numerical methods was done for solving the equations of elasticity with higher order of accuracy to be applied to assess the earthquake resistance of structures. A facility for carrying out nonlinear dynamic analysis of the structures is being built.

Software for Estimation of Stall Characteristics

A customized software for estimation of stall characteristics and surge alleviation for a multi-stage compressor, was developed for GTRE, Bangalore, in collaboration with M/S Zeus Numerix, Mumbai. This involves development of a methodology for the prediction and prevention of rotating stall and surge of a compressor stage. This will result in better design of axial flow compressor for aerospace applications.

Numerical Investigation of the Unsteady Flows

Numerical investigation of unsteady flows around blunt bodies was done in collaboration with, ICAD Moscow. It involved development of a parallel computational fluid dynamics (CFD) code for the separated flows around blunt bodies, which are usually observed in river and sea water. This would be useful for designing submarine equipments.

Earthquake Engineering Applications

Porting of open source OpenSEES software framework system, used for Earthquake and Structural Engineering applications, was done on Hybrid Architecture based HPC, thereby resulting in its accelerated performance.

Grid Computing

HPC and Grid Deployment

PARAM-Nkontabu at Accra, Ghana

C-DAC upgraded the PARAM HPC Facility, PARAM-Nkontabu, at Advanced Information Technology Institute (AITI), Accra, Ghana. This state-of the-art facility provides a dynamic environment for research and innovation. It is a hybrid

cluster equipped with Intel Sandy Bridge processors and nVIDIA Tesla GPU cards. Applications from various scientific domains such as Molecular Dynamics, Quantum Mechanics, Bioinformatics, Climate Modeling, Astrophysics and Computational Fluid Dynamics have been ported on this cluster.

National Agricultural Bioinformatics Grid (NABG)

C-DAC established a National Agricultural Bioinformatics Grid (NABG) for the Indian Council for Agricultural Research. The Centre for Agricultural Bioinformatics (CABin) will support this grid under a World Bank funded project and will carry out biotechnological research. The main objectives of the project include, Development of agricultural bioinformatics grid for the country, Creation of local databases and Bioinformatics Data Warehouse (BinDW) for genomic resources across species, and Human resource development in agricultural bioinformatics.

GRID Tools

GARUDA Access Portal (GAP)

GARUDA Access Portal provides a web interface for submitting Jobs to Service Oriented GARUDA grid, viewing the available resources in GARUDA grid environment and to monitor the Job status. It supports Resubmission of Jobs and Monitoring the Job Status through SMS facility using mobile phone. GAP provides a user-friendly interface for using GARUDA grid.

Automatic Grid Service Generator

Automatic Grid Service Generator (AGSG) is used to generate services on a Globus 4.x based Grid. It has been targeted for the GARUDA Grid users/developers who want to convert their applications as a Grid service and deploy on Garuda resources. It frees the user from the complexity involved in making a Grid service. It also provides interface for requesting to un-deploy a Grid service.

Security Assessment System

Security Assessment System (SAS) is a vulnerability and threat assessment system designed over a scalable architecture that is suitable for distributed systems. SAS conducts network audit of the grid by performing vulnerability and threat assessment on the nodes of the institutes that form part of the network. SAS allows the administrator to monitor the threats and vulnerabilities associated with the nodes and take appropriate measures for reducing the intensity and mitigating the risks. Using SAS, administrators can obtain the audit information about all the connected nodes from a single location.

GARUDA Storage Resource Manager (GSRM)

GSRM is a peer-to-peer data grid solution for SOA based GARUDA. It is an interoperable and optimal data management solution for GARUDA grid. GSRM adheres to OGF standards. It is based on disk based open source srmv2.2 implementation. Currently, GSRM has total storage capacity of ~2TB (expandable to 100s of Terabytes) distributed at multiple locations.

GRID Applications

Collaborative Class Room

Collaborative Class Room (CCR) is an online virtual class room environment which facilitates any time, any place learning through real time audio/video conference and accesses computational and storage resources of GARUDA Grid. CCR is beneficial to educational institutes interested in adapting eLearning solutions on a large scale in their respective centers. CCR has capability to build online educational network among academic and research institutes.

Seamless access to the resources (courses, assessment, A/V conference, etc.,) being controlled by the educational and/or research institutes which want to collaborate with each other can be facilitated by CCR. CCR is cost effective and provides customized solution to the institutes. Institutes can set up their own server with customized look and feel while saving the content on grid repository without worrying about required storage space at their premises. Its key features include, User Registration & Login Activity Report, Course Preparation Utility, Audio/Video Conference facility and grid Storage for Content.

Galaxy Workflow on GARUDA Grid

Galaxy is an easy-to-use, open-source, scalable framework that is popular in the Bioinformatics community. Scientists can perform biological data analysis by invoking tools available in Galaxy. It provides an environment for interactive analysis, a workflow system for convenient reuse, data management, sharing and publishing of results. Galaxy is available on the OSDD Head node connected to GARUDA and can be accessed using GARUDA login mechanism. It is integrated with Gridway meta-scheduler for job submission. Its key features include ability to upload the biological datasets, provision to connect to external databases for fetching data, etc.

Earthquake Risk Analysis System

The Earthquake Risk Analysis System for RCC Frame Structures was deployed on Grid GARUDA. It helps in carrying out Incremental Dynamic analysis for RCC Frame structures using OpenSEES and IDARC software. A web portal facility facilitates carrying out earthquake simulations of structures. Collection of various Earthquake records and data bank for the same was also done.

TaxoGrid : Phylogeny on Grid GARUDA

TaxoGrid is the implementation of phylogeny which finds evolutionary relationship between genes, genomes and organisms. It is a fundamental tool to understand the origin of biochemical pathways, regulatory mechanisms in cells as well as the development of complex systems. One of the bottlenecks for such studies is the compute-intensive nature of the phylogenetic reconstruction, as the search space depends on the number of characters. Character-based methods like maximum parsimony and maximum likelihood scan each column of the alignment to arrive at the best tree topology while accommodating all the information. TaxoGrid Portal was developed to facilitate use of this software.

Cloud Computing

Cloud Platforms

Meghdoot - Open Source Cloud Stack

Meghdoot is a free and open source cloud stack developed by C-DAC as a one stop solution for establishing Cloud environment. The product is a single middleware bundle that incorporates all pre-requisites and tools across all layers to implement cloud. Apart from various third party tools, this stack has certain value added features and functionalities that convert a data centre into a cloud centre.

Meghdoot offers various features in cloud environment such as Platform and Infrastructure as a Service (PaaS and IaaS), On demand dynamic provisioning, Metering & Monitoring, Graphical Installation of Middleware stack, Web based Management of Cloud resources, Provision for deployment of multi instance user appliances, Customized Elasticity, Web service based management of cloud, High Availability, and Enhanced Security across layers.

Release of Meghdoot 1.0 at Technology Conclave, Hyderabad

Megha – Cloud Platform on Grid GARUDA

Megha is a cloud computing platform built on top of the Garuda resources. This is a platform where grid and cloud computing converge and makes the best of both world. GARUDA provides an aggregated resources comprising of computational nodes, mass storage and scientific instruments distributed across the country. Megha exploits the utilization of these resources and also avoids idleness of fragmented GARUDA resources. Megha offers Infrastructure and Software as a Service (SaaS) focusing mainly towards scientific community. Users can request for a machine which is dynamically created and can be accessed through SSH connection. Some of the applications on Megha include, SFM - Seasonal Forecast Model - a weather prediction application; FASTA – Protein Sequence Analysis - a bio-informatics application; and Scilab - Open Source Equivalent of Matlab.

Cloud Services and Tools

Cloud IaaS Services

Scientific Cloud IaaS services enable users to request for the virtual resources and have an easy and quick access to them using the Internet. Users can request for Virtual Machines (VMs) or Virtual Clusters (VCs). The requested VM/VC is created automatically. Once the VM is up, the portal shows the status of VM as running and the user is provided with the IP of the head node and security key to login. The user gets the root permissions for the VM and is allowed to do following: Save the VM image, shutdown or boot the VM, monitor his VMs using NAGIOS, and destroy the VM. It also provides access to Elastic storage that enables users to have access to on demand storage attached to their virtual machines & virtual clusters allocated through scientific cloud.

Cloud Vault (Storage as a Service)

Cloud Vault provides on demand access to huge storage space. It provides a convenient and affordable way to store, share, and archive data, including extremely large data sets. The object based storage system and multiple interface methods ensure ease of usability in general, and also provide a flexible, configurable, and expandable solution to meet the needs of more demanding applications. The service enables users to access cloud storage from anywhere, anytime for uploading/downloading their data using the browser and allows users to share their data with others. It also provides Linux clients using which users can access cloud storage service from Linux based desktop, HPC clusters, virtual machines and virtual clusters.

Disaster Recovery as a Service over Cloud

With the expertise of Storage networking and Disaster Recovery Appliance Revival 1000 and Revival 2000, C-DAC, Mumbai has developed a Disaster Recovery (DR) Service over PAN C-DAC Cloud. This combines the benefits of disaster recovery and a cloud environment to the user for providing complete cost effective disaster recovery solution. The disaster recovery solution will be offered as a service to manage applications. The Disaster Recovery service offered by C-DAC Cloud will be easily scalable without interrupting the infrastructure setup and cuts down on cost and energy usage as compared to traditional setup.

Job Submission Portal for Scientific Cloud

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Seasonal Forecast Model (SFM) PSE

PSE for SFM provides a web-based GUI for submission of a Climate Modeling application to the Scientific Cloud. SFM is an efficient, stable, state-of- the-art atmospheric general circulation model designed for seasonal prediction and climate research. It is a free resource available to the research and academic communities under research license. It is designed using SPMD (Single Program Multiple Data) programming model. It can run on sequential, shared memory parallel as well as distributed memory parallel machines. This will be achieved by preprocessing the code before it is compiled on different machines.

PSE for Next Generation Sequencing (NGS) Workflow

PSE for NGS Workflow provides a web-based GUI for submission of a climate modeling application to the Scientific Cloud. This PSE is about developing an online tool for analysis of next generation sequencing. There is a need to build an online tool using which users can analyze raw unformatted genome sequences against reference genomes. After formatting the input sequences, and aligning/mapping with respect to reference genome, users can visualize different things such as SNP detection, transcriptiomic analysis, etc.

Multilingual Computing and Heritage Computing

India is a multilingual country with as many as 22 scheduled languages. Only about 7% of the population is able to understand English. Therefore, any language computing solution provided for a language will have to be provided for all or most other languages too. Language computing, therefore, faces two major challenges – first, the development of appropriate language tools and technologies for its total language computing needs and secondly the multiplicity of Indian languages with different scripts, dictions and styles, each vying for a place in the computing roadmap. The ultimate goal of multilingual computing is to ensure that the technology reaches the common man at his doorstep, in his own native tongue, so that he feels more at home working with the new technology. This, in turn, will facilitate his active involvement in the whole process of social and economic advancement that the new technology is expected to bring about. The activities carried out by C-DAC during the year in this thematic area are described below.

Multilingual Search Engines

Cross Lingual Information Access (CLIA) System

Development of CLIA system is a consortia based project, funded by DeitY, in which most of the C-DAC centres are participating. In the first phase of the project, Bengali, Hindi, Marathi, Tamil and Telugu languages were covered and monolingual search engines for these languages were released and made available through the www.tdil-dc.in portal. In the second phase, apart from the above languages, Assamese, Oriya and Gujarati are added. Currently, migration to higher version of Nutch, Solr and Hadoop is in progress.

Information Extraction & Retrieval Tool for Election Commission

This tool extracts Video, Audio and Textual Information in English, Hindi and Gujarati as per the identified items to initiate appropriate action against violations of Model Code of Conduct (MCC) for 2012 Gujarat Election. It has the following features:

- Collection of data from different media sources, for example, Newspaper, Television News and Web
- Facility for Keyword Search on Video, Audio and Textual News data through keyboard input in English, Hindi and Gujarati with date filter option
- Meta search facility to query on web data and newspaper website
- The results are shown in clustered fashion automatically arranging results into similar conceptual sets in order to facilitate users to view results in an ordered fashion among the searched results

The tool when deployed in Gujarat, identified suspected news from different sources. The tool can as well be used during elections at State and National levels to capture MCC and Paid News violations.

Machine Translation and Transliteration Systems

English to Indian Language Machine Translation (EILMT) System

This development activity is being carried out in consortia mode with participation of C-DAC's Thiruvananthapuram, Hyderabad, Noida, Pune and Kolkata centres. Its aim is to develop English to Indian language machine translation systems using state-of-the-art statistical machine translation approach. Thiruvananthapuram centre is working on English to Malayalam; Hyderabad centre on English to Telugu; Noida centre on English to Punjabi, Urdu and Hindi; Pune centre on English to Marathi; and Kolkata centre is working on English to Bangla and Assamese. Some of the activities undertaken during the year are:

- Preprocessor module modification to include symbols
- Transliteration module was modified and is now getting accuracy of more than 85%
- Standalone transliteration module was developed

- Translated a book titled “Raman and His Effect” written by G Venkataraman by AnglaMT system
- More than 10 papers were published in national and international journals

Speech-to-Speech Machine Assisted Translation Dialogue System

This is a consortia mode project being executed by Pune, Mohali, Noida, Kolkata and Thiruvananthapuram centres of C-DAC. Its objective is to design, develop and deliver an integrated Speech-to-Speech Machine Assisted Translation (MAT) based Dialogue System for Hindi to Indian Languages namely: Hindi–English, Hindi-Bangla, Hindi-Malayalam and Hindi-Punjabi language pairs for Tourism and Education domains. Along with technical development as mentioned here, the Linguistic Resources Creation is also an important task which includes creation of bilingual parallel text corpus, creation of lexicons and creation of speech corpus.

The end result would be a Speech-to-Speech MAT based dialogue system where the input language would be in speech form in speaker’s local language and the output would also be in speech form in listener’s local language. This technology would enhance the various government level activities in Education and Tourism domains of different states such as Kerala, West-Bengal, Punjab and Northern states of India, apart from meeting the important requirements/needs of the society. This innovative idea also aims at solving the language barriers, which exists today across the regions of India, taking a step at a time. As a part of this initiative, C-DAC is developing Automatic Speech Recognition (ASR), Machine Aided Translation (MAT) and Text-to-Speech (TTS) components.

I-Suggest Transliteration System

I-Suggest is a new and fast transliteration mechanism, for transliterating English text to Indian languages and vice versa. It is available in nine languages, viz. Hindi, Marathi, Gujarati, Urdu, Nepali, Tamil, Telugu, Malayalam and Bangla. It has facility to transliterate Proper nouns, Compound words and General text. It is ISCII and UNICODE compliant, and can be used in standalone applications and Web applications.

Multilingual Speech Technologies

Indian Language Text-To-Speech (ILTTS) Systems

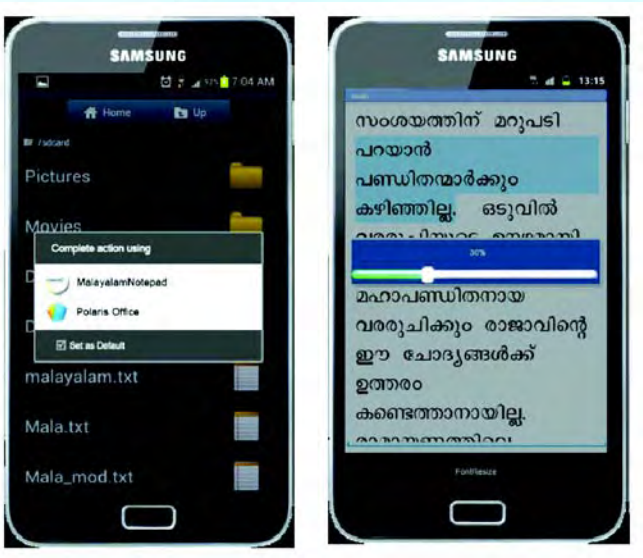
This is a consortia mode project, with IIT Madras as the leader and IIT Kharagpur, IIIT Hyderabad alongwith C-DAC Mumbai, Kolkata and Thiruvananthapuram centres as members. The main objective of this project is to develop a SAPI (Speech Application Programming Interface) compliant speech synthesis engine, supporting Hindi, Marathi, Tamil, Telugu, Malayalam and Bangla. Thiruvananthapuram centre did the language specific development for Malayalam, Mumbai centre did for Marathi and Odiya, while Kolkata centre did for Bangla. Applications of the system include IVR systems, Automatic reading of electronic documents, and Reading system for the visually challenged.

During the year, the development effort has produced good results. For example, Festival TTS was customized for Malayalam and used for both Windows and Linux platforms. The engine was integrated with open source screen readers for windows (NVDA) and Linux (ORCA). A Mizo text reading system for visually challenged people of Mizoram was developed. A scanned Mizo-document, when fed to the Mizo-OCR system integrated with Mizo-Text-To-Speech synthesis system, generates corresponding voice output in Mizo language.

Small Footprint TTS for Mobile Applications

The activity involves development of TTS for android platform. The application uses the concatenation based ESNOLA TTS engine. The basic units for concatenation are partnemes (diphone like units). The size of database is less than 3 MB and the Mean Opinion Score (MOS) is 3.2. It has a user friendly interface with options to change font size, save and edit documents, and trace the text being read by highlighting. The current development work is focused on Malayalam language.

During the year, Mozhi-Malayalam TTS was developed for android platform. It can read text in UTF8 format. Users can download Malayalam text and listen to it. Main advantage is that the application can serve as an eyes-free text reader. The application also helps “differently abled” persons to read text without assistance.



Small footprint TTS for mobile

Malayalam ASR (Automatic Speech Recognition) System

During the year, C-DAC developed a speaker independent ASR for Malayalam, based on Hidden Markov Model (HMM) technique, which is the most accepted method for speech recognition today. The package finds applications in Interactive Voice Response Systems (IVRS), Dictation systems, Speech-to-Speech translation systems, Language learning, and in sectors like Telephone, Telecommunications, Media and Entertainment.

The open source speech recognition toolkit (Sphinx), developed by Carnegie Mellon University (CMU) has been used to develop this software. The software package supports Grapheme to phoneme conversion and has a repository of phonetically rich text corpus, a pronunciation dictionary of over forty thousand words and a speech corpus.

Interactive News Reading System for Malayalam [INRSM]

Interactive news reading system is an application which collects, classifies, extracts, updates and reads the news from Malayalam newspaper web sites. The user of the system will be able to control the system operations through voice, keyboard or mouse. The system integrates both Automatic Speech Recognition (ASR) and Text-To-Speech (TTS) with web.

Major application of this product is in the form of an assistive technology for visually or physically challenged, senior citizens and illiterate persons. The system helps them in updating their general awareness without any external support. It can also help busy persons to read newspaper, as it provides hands-free access to news sites.

Speech-based Access for Agricultural Commodity Prices

The objective of this activity is to implement and deploy a speech based system using which any user (especially farmers) can get prices of agricultural commodities by speaking over telephone or mobile in his/her local language (currently in six Indian languages). For this purpose, data was collected from the farmers in two phases, and about 3000 numbers of farmers speech data has already been collected. One semi automatic transcription tool was developed for speech data transcription. Phonetic dictionary and Language model were developed for the collected data. Using this data, one demonstrable (Version 4.0) system was built-up that can recognize and give the price information corresponding to all districts and commodities of West Bengal. Field testing and evaluation are going on for this project.

OCR (Optical Character Recognition) and OHR (Optical Handwriting Recognition) Systems for Indian Languages

Oriya OCR

C-DAC developed an Oriya OCR that provides facility to convert text from scanned image of machine-printed Oriya script. Supported formats are .tiff, .png, .bmp and the same is tested over 4000 images. Its character level accuracy is about 85%.

Malayalam OHR

Modern Malayalam script “Grantha” has its evolutionary roots in the ancient script “Brahmi”. With more than 900 characters, 13 vowels, 36 consonants, 5 Chillus, Anuswaram, Chandrakala, and Visargam as well as a number of Conjunct consonants (combination of multiple consonants), automatic machine recognition of Malayalam script, even in printed form, is very difficult. Recognition of hand-written characters and words is still harder and is a highly complicated affair.

The system developed uses Simplified Fuzzy ARTMAP (SFAM) classifier, a special class of neural networks, which are capable of incremental learning, for classification and recognition. The SFAM classifier compares the input data with the trained data and finds the nearest prototype from the database that ‘resonates’ with the input pattern. The system has applications in reading postal addresses, bank cheque amounts, hand-written fields in forms, etc. It can also be used in businesses which process lots of handwritten documents, like insurance companies.

Bangla OHR

C-DAC has designed a Bangla OHR based on pattern recognition technique applied for recognizing handwritten Bangla characters online, using digital pen tablet as input device. It can handle all alphanumeric characters and compound characters used in Bangla handwriting, and can also handle selected Bangla medicinal words. The system takes online pen tablet data as input and the output is stored in Unicode file format.

T-Learning Suite

T-Learning suite is an enabling technology for educational television broadcasters to deliver engaging interactive educational services. This caters to the need of producers and broadcasters of educational TV programs in the content authoring, acquisition, management, scheduling, transmission and management of return channel interactions of learning services on digital TV.

This solution is designed to cater to the interactivity needs on television with and without the availability of the return channel in the set-top box. This value added interactivity through set-top box keeps the learner engaged to the educational programme, promoting viewers participation in television based learning environment. The interactive educational application is strategically designed to serve as a template to reuse e-learning contents. This offers the learner-viewer with the facility to take the lecture notes, self evaluation tests and access supplementary information, making learning a fun and a holistic experience in their local language.

The uniqueness of the suite lies in its design for Indian scenario, enabling localized content. The solution includes efficient localization tools for generation of learning services in local languages. With the proposed launch of fifty more educational DTH channels by the Government of India, this suite has tremendous scope and applications for bringing knowledge to all in local languages.

A snapshot of T-Learning Suite

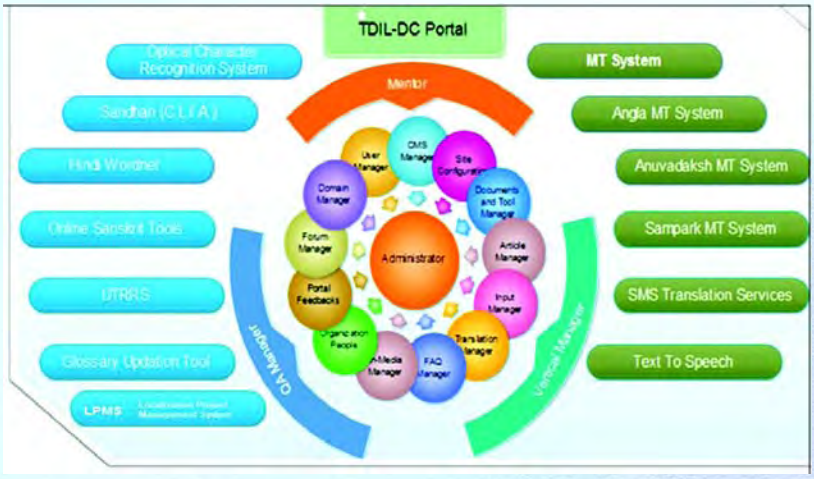
Internationalized Domain Names (IDN) for Indian Languages

The main aim of this activity is to ensure that a user can create and access URLs in his/her own language. Key features of the developed software are:

- Augmented Backus Naur Formalism (ABNF): A thorough study of all the Indian languages as per the Akshara formation rules in the form of ABNF formalism.
- Policy documents for all the languages: Policy document for each Indian language containing ABNF, restriction rules, Unicode code chart for each language, Variants and Country Code Top Level Domain (ccTLD) string of the language.
- Language Validation APIs: An API which will validate the input domain name as per the Akshar formation rules. Language Generation APIs: An API which spews out all variants of the input domain name.
- Various tools for secure and easy access of IDNs

Indian Language Technology Proliferation and Deployment Centre

C-DAC developed a single window system for hosting and distribution of the outcomes of TDIL, DeitY funded projects. It also acts as a national repository for linguistic resources, standards, contents of language CDs, tools and applications being developed under the various DeitY/TDIL funded projects. It is developed in Joomla, which aims at providing centralized repository and is designed in the form of 'Verticals'. Standardization, Linguistic Resources & Tools, Validators/Localization Tools, Application Showcase, Research Areas, Technology Handshake and IPR are the existing verticals. More details are available at **http://tdil-dc.in/**



System diagram of TDIL Deployment Centre Portal

Multilingual Data Entry Tools and Technologies

Enhanced INSCRIPT Standard

Enhancement of existing INSCRIPT keyboard layouts for ISO IEC 10646:2012 and making them language-wise was carried out during the year. The standard provides the INSCRIPT language keyboard layouts for Brahmi based languages.

Intelligent Script Manager

Intelligent Script Manager family of products from C-DAC underwent several updates and customizations. It supports 19 Indian languages, namely Assamese, Bangla, Gujarati, Hindi, Kannada, Marathi, Malayalam, Oriya, Punjabi, Sanskrit, Tamil, Telugu, Manipuri, Nepali, Konkani, Bodo, Santhali, Maithili, Dogri, in addition to Roman English.

Now the Intelligent Script Manager is compatible with frequently used applications such as Windows 8, Windows 2012, MS Office 2013 (64 bit), Libre Office (3.4, 3.5, 3.6, 4.0), Open Office 3.0, Internet Explorer and Mozila Firefox.

Text Word Prediction APIs for English and Indian Languages

A syllable driven, rule and dictionary based prediction engine has been developed for Hindi. A word based prediction, which is based on frequency, has been developed for English. Both predictions have a self learning mechanism. Core APIs that are easily integrated into other applications have been developed.

INSCRIPT Typing Tutor

C-DAC has developed an interactive application to learn Enhanced INSCRIPT typing. This is currently developed for Marathi and Hindi languages. It is Unicode based application having attractive user interface and a clear indication of which fingers to use. It has seven lessons with more levels to practice and test typing. Three games are also included with some levels options. In the beginning of the typing lessons, user will be practicing with letters. As user gets to know the keys, user will use words and sentences. It measures typing speed periodically - with typing test and check progress in both speed and accuracy. The number of words per minute indicates typing level. If user is still not satisfied with the results, he/she can go back to the INSCRIPT Typing Tutor and keep practicing!

Telugu SDK for Android Platform

The SDK has been developed to support application development in Telugu on Android platform. It consists of highly optimized layout engine stack, customized scalable fonts, basic editor, customized widgets/classes, interfacing APIs, etc. It has been used in land record system application and ported on 200 numbers of Android based tablets.

A snapshot of Telugu SDK support on Android platform

On-screen Keyboard Drivers for Android Devices

C-DAC has developed a basic editor for Indian languages for Android devices. Currently, the languages supported are Hindi, Marathi, Gujarati, Bangla and Tamil. It works on Android version 2.3 and above. The sample basic editor application is for sample editing of text in supported Indian languages, and is useful for getting familiar with inputting text in supported Indian languages. This sample editor application is available for free for non-commercial purposes only.

Localization Initiatives

Localization Tools and Solutions

Considering the need from the PSUs and other Government organizations in India, C-DAC has taken a step ahead to localize ERP solutions in Hindi. Some of the localization work carried out by C-DAC includes the following:

- Translation of contents related to Employee Self Service module
- SDK to support Telugu on Android devices related to G2C services, Govt. of Andhra Pradesh and to implement and monitor various welfare programs of Govt. of Andhra Pradesh
- Solution for Indian languages was provided to international printer manufacturers to enable their printers to print in Indian languages
- Solution for Indian languages was provided to a Swiss company that manufactures hardware and software digital security and convergent media systems for the delivery of digital and interactive content. It also develops condi tional access systems for cable and satellite television. C-DAC's technology ensured that the Electronic Programme Guide (EPG) of the set-top-box of the company is available in local Indian languages
- Provided ISM V6 and Tahreer Urdu software for Doordarshan to a Chennai based broadcast corporation

Centre of Excellence for Marathi Language Computing

Government of Maharashtra in collaboration with C-DAC has setup a Centre of Excellence (CoE) for Marathi Language Computing. The purpose of this center is to assist Government of Maharashtra and its various consulting bodies on various issues related to Marathi Language computing, suggest them the best practices to conceptualize and develop state-of-the-art web and desktop applications, train Government employees for effective usage of desktop and web applications, and in doing so create content which is error free and adheres to the latest international Unicode standards. Data thus created is portable and usable to the entire world. CoE team is working in close tandem with the Department of Information Technology, Government of Maharashtra, to meet the above objectives.

The activities, outcomes, guidelines and resources of the CoE are hosted at **http://coe.maharashtra.gov.in.**

Shri Prithviraj Chavan, Hon'ble Chief Minister of Maharashtra, launching the Centre of Excellence for Marathi language computing

C-DAC is also working with State Government of Maharashtra on digitization of Marathi language literary work. These include the following:

- Digitization of all 19 volumes of Marathi Vishwakosh has been completed. The same is available at http://www.marathivishwakosh.in

- Digitization of state magazine named “Lokrajya”. Out of around 1500 such magazines since the year 1947, C-DAC has successfully completed digitization of around 800 magazines till date and the work on remaining is underway. One can access these magazines from the web portal - http://dgipr.maharashtra.gov.in.

Centre of Excellence for Digital Preservation

With the objective to preserve Indian heritage in digital form, DeitY has established a Centre of Excellence (CoE) for Digital Preservation at C-DAC, Pune. The activities carried out by the centre during the year are described below.

Digital Preservation Standards

The digital preservation standards and guidelines are being developed based on the study of electronic records produced by various e-governance mission mode projects.

Best Practices and Guidelines for Production of Preservable e-Records (PROPeR)

This standard provides the best practices and guidelines for production of preservable electronic records and its management in the context of e-governance. It is applicable to those e-records that need to be retained for long duration (e.g. 10 years, 25 years, 50 years and beyond), and the e-records that need to be preserved permanently.

e-Governance Standard for Preservation Information Documentation (eGOV-PID) of Electronic Records

The e-GOV-PID provides the standard metadata dictionary and schema for describing the preservation metadata of an electronic record. This standard proposes to capture most of the preservation information (metadata) automatically after the final e-record is created by the e-government system. Such preservation information documentation is necessary only for those e-records that need to be retained for long durations (e.g. 10 years, 25 years, 50 years and beyond), and the e-records that need to be preserved permanently.

Professional Electronics

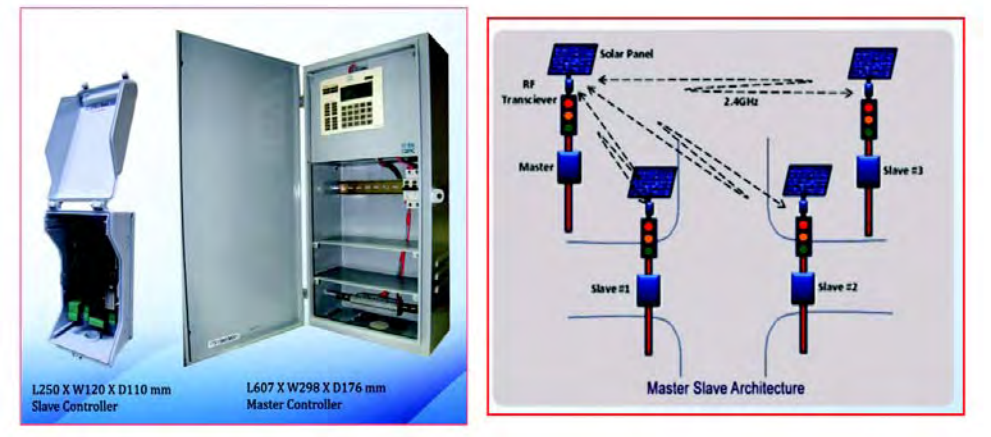
The primary objective of this thematic area is to design, develop and deploy globally competitive Professional Electronics products for industrial development and social empowerment. Research themes that are part of this thematic area of C-DAC include VLSI and Embedded Systems, Power Electronics Systems, Systems for Agricultural and Environmental Monitoring, Intelligent Transportation Systems, Control Systems for Industrial Automation, Strategic Electronics Systems for Defense, Space and Nuclear Segments, and Systems for Strategic and Mass Communication. The activities carried out during the year in this thematic area are described below.

Intelligent Transportation Systems

Wireless Traffic Controller (WiTRAC)

WiTRAC is a vehicle actuated road traffic signal controller that controls the traffic signals without wires. As an Area Traffic Control System (ATCS), it can perform at selected traffic junctions or over several junctions as part of a synchronized chain of controllers. The controller supports remote monitoring and management of signaling. Features include optimized Solar power operation, PWM based intensity control of signal lamps, GPS / Server based distributed time synchronization, pole mountable miniature architecture, etc. WiTRAC has been developed under the programme "Intelligent Transportation System Endeavour (InTranSe) for Indian Cities", a National level Collaborative Research and Development Program, funded by the DeitY. The first system was deployed at the Vellayambalam Junction in Thiruvananthapuram, Kerala, on May 29, 2012. The Vellayambalam project was a joint research project by Kerala Road Fund Board (KRFB), C-DAC and Keltron.

The hardware is based on a 32 bit microcontroller with distributed architecture (one Master controller and up to 15 Slave controllers) and uses unlicensed 2.4GHz Band. Since it is wireless operated, no cables are required for signal posts, and therefore, no road cutting for laying the cables. The system works on Solar Power (12V DC) with pole mountable Master and Slave controllers.



WiTRAC System

Electromagnetic Log Version.3 (EMLOG V3)

Electromagnetic Log (EMLOG) is an instrument used to measure the speed, and hence, the distance traveled by a ship. The operation of EMLOG is based on a physical phenomenon – that of electromagnetic induction. The system consists of a pick-up head (Transducer), fitted at the hull of the ship, which generates a magnetic field that extends into the sea water. The pickup head also contains two electrodes which are is in contact with the sea water. When the ship moves, the water between the electrodes acts as the conductor moving in the magnetic field, and a voltage proportional to the speed of the ship is induced across the electrodes. This small voltage is picked up and processed by the system to compute and display the speed of the ship and the distance traveled by the ship.

The system comprises of (i) a Master Unit (to detect, process and display the speed and distance traveled), (ii) a Repeater (interfaced with the Master Unit, to display the speed and distance traveled at different locations on board ship), and (iii) a Re-transmission Unit (interfaced with the Master Unit, to convert the speed information into appropriate formats suitable for other equipment on-board ship).

Safety Alert & advisory information system using VEhiculaR Communication (SAVER)

Vehicular Communication System (VCS) is an emerging network technology in which vehicles and roadside units act as the communicating nodes providing each other with information, such as safety warnings and traffic information. As a cooperative approach, VCS can be more effective than individual vehicles trying to solve traffic issues. C-DAC is developing an on-board equipment (OBE) in a vehicle and a Road Side Equipment (RSE) for vehicular safety that communicates over a wireless network complying with Dedicated Short Range Communication (DSRC). OBE and RSE would be integrated into a collision avoidance application, to avert such occurances and alert the driver, at intersections and on high speed roads.

Research in Origin – Destination (OD) for Urban Transportation Enhancements (ROUTE)

Origin-Destination studies are often used in transportation planning to determine the travel patterns (OD matrix) of vehicles and goods in a particular area. Given these travel patterns, the impact of alternative solutions to current and future transportation problems can be evaluated. Therefore, it is important to measure the travel patterns accurately. Acquiring high-quality OD information for traffic in a geographic area is both time consuming and expensive, unlike using conventional methods such as household surveys or roadside monitoring. These methods generally present only a snapshot of traffic situation at a certain point in time, and they are updated in time intervals of up to several years. The objective of this project is to make use of the global system for mobile communications (GSM) mobile phone network for analyzing OD statistics. Instead of monitoring the flow of vehicles in a transportation network, the flow of mobile phones in a cell-phone network is measured and correlated to traffic flow.

Intelligent Systems for Smart Buildings

Data Centre Environment Monitoring and Alert System (DCEMAS)

DCEMAS is a monitoring and alert system for temperature and relative humidity. It collects data using Zigbee based wireless sensor motes. DCEMAS performs the functionalities like Zigbee network formation by the Coordinator (sink node), node joining into the network, node leaving from the network, and displaying of data from sensor motes on the user friendly GUI.

Zigbee enabled LED Luminarie (Z-LED)

A Zigbee controlled dimmable LED luminarie has been developed for providing energy efficient illumination in buildings. 15-22% energy savings could be achieved by Z-LED replacing T8 fluorescent lamps. Twenty levels of dimming could be selected for optimum illumination in a work place. The LED fixture is thermally stable with LED fault indication. Wireless (Zigbee) control of light and wireless monitoring of fixture temperature is done for increasing longevity of LEDs.

Dimming of light could be based on activities of a user. Different light levels are required for various activities. The activity recognition framework determines the activity performed by the user, using the data from accelerometer and RFID. Alternatively, the light can be turned on/off based on the occupancy in the room detected by a Passive Infrared (PIR) sensor. The occupancy of the room can also be predicted using Hidden Markov Model (HMM). Once the occupancy modeling for the room is done, sensor may not be required for light control. If a user wishes to override the automatic control, an additional option of turning on/off or dim the lamps using mobile phone is provided through an application installed in the user's mobile phone.

Wireless Mesh Network for Building Automation

Wireless sensor network is constructed using the ZigBee Protocol for Building Automation Profile. The network consists of ZigBee Coordinator (ZC), ZigBee Router (ZR) and ZigBee End Devices (ZED). ZigBee stack is based on IEEE 802.15.4 Physical and MAC Layer. ZigBee transmits the data over the air by using unslotted CSMA-CA mechanism. In this project, Ad-hoc On-demand Distance Vector routing (AODV) for mesh topology and Hierarchical Routing for Cluster-tree topology have been implemented. The implementation has been carried out on C-DAC motes with CC2430, and tested under indoor laboratory environment.

Human Occupancy Prediction using Hidden Markov Model

The objective is to develop and implement algorithms for sensor based modeling and prediction of user occupancy in intelligent buildings using Hidden Markov Model. The knowledge of occupancy patterns is vital for controlling energy and operating comfort management systems. The system will monitor the presence of a person using sensor events and determine the current state of the environment. If a person enters a room, the system computes the most probable duration of occupancy based on the occupancy model and responds accordingly (e.g., turning lights on/off, optimal control of HVAC based on duration of stay).

Indoor Air Quality Monitoring System

An Indoor Air Quality Monitoring system has been developed for measurement of CO, CO2 using WSN motes (Libelium), and particulate matters (PM1.0, PM2.5, PM4.0, PM10.0) using aerosol monitors. Air Quality index has been calculated as per Environmental Protection Agency (EPA) standards from these measurements. The proposed solution is to measure the environmental parameters like temperature, humidity, gaseous pollutants, aerosol/particulate matter to determine the environmental health of an indoor space.

Industrial Automation Systems

Wireless Sensor Network (WSN)

WSN provides highly reliable industrial grade sensor nodes with effective sensing, processing and communication algorithms, which can address the unique challenges posed by the systems and their working environments. C-DAC has developed two products – Wireless Sensor Node (iWiSe) and Base Station for Wireless Sensor Network (iWase) to meet the challenge, as part of the ASTeC programme. The main components of a typical sensor node include a Sensor Unit, a 16-bit microcontroller with memory, a Radio transceiver (IEEE 802.15.4/ Zigbee-2.4GHz) with provision for both external and internal antenna to allow communication with other nodes, and a power source which may be solar power or external power source. The Wireless Sensor Base-station Unit (WSBU) acts as a gateway between the WSN and the external world. The WSBU has an IEEE 802.15.4 radio interface (2.4 GHz) for collecting data from the sensor nodes. The data captured is processed, stored and sent to a server for monitoring purposes. The WSBU provides two communication interfaces – a wireless interface (GSM/GPRS) for communication with the remote server and a wired interface (Ethernet) to connect the WSN to a SCADA network. The module is capable of operating in harsh environmental conditions with an operating temperature of -40°C to +85°C and an ingress protection of IP65.

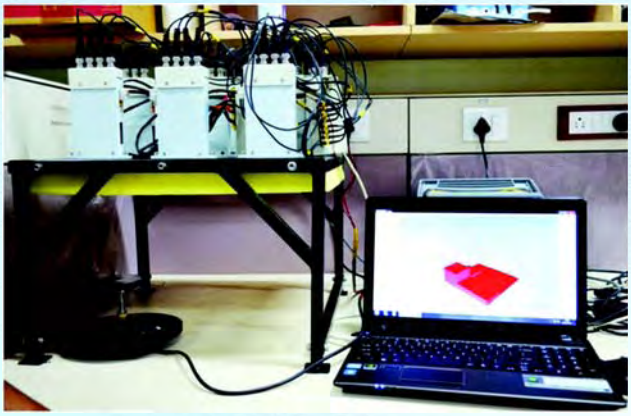
C-DAC has successfully demonstrated the WSN in a 110KV substation switchyard monitoring application, at Kerala State Electricity Board (KSEB), in Paruthippara. The system helps at on-line monitoring of the transformer parameters such as winding temperature and oil temperature as well as the close and open status of circuit breaker and various alarms.

Non-contact Vibration Analyzer (NOVIA)

Vibration measurement of machineries, structures, electronic assemblies, etc. is a widely used health monitoring and failure prediction technique. In Non-destructive impact testing, vibration measurement is used for material characterization and observation of structural integrity. The most widely used vibration sensors are accelerometer-based, in which the sensor has to be in contact with vibrating surface. The primary disadvantage of this method is that since the

sensor is touching the vibrating surface, the mass of the sensor may affect the resonance characteristics of the vibrating surface. Currently, the equipments available for non-contact vibration measurements are based on Laser techniques which are very costly and bulky. C-DAC has developed a compact and scalable Non-Contact Vibration Measurement and Analysis System, based on Multi-dimensional profiling of vibrating surface (which includes frequency, amplitude, position information varying over time).

Application areas include PCB vibration profiling, flaw detection of highly attenuating porous materials, Bond strength evaluation of materials, Vibration profiling of high temperature surfaces, etc.



Non-contact Vibration Analyzer (NOVIA)

Power Electronics Systems

Advanced Process Control (APC) Library & Implementation of APC Functionality

APC functionality consists of embedded function blocks of Enhanced PID controller (EPID), Auto tuning PID Controller (APID), Gain Scheduled PID Controller (GPID), Fuzzy Logic Controller (FLC), and Model Predictive Controller (MPC), which run in the controller along with the Human-Machine Interface (HMI). Complex computational algorithms (FLC and MPC) are run as external functions in the computer system. Embedded–External system architecture used in the implementation makes it easy for the system to adapt to the user requirements. Advanced Control Algorithms developed in this project meet the requirements of most of the on-line advanced control applications encountered in industrial processes, which helps to optimize the product yield and quality while minimizing consumption of energy and raw materials.

The use of APC functions helps to minimize fluctuations of critical process variables, helps to decrease manual intervention and relieve operating points, optimizes the transition between various operating points, and increases the service life of the plant while reducing maintenance costs. Application areas include Process Industries, Power Plants and Metallurgical Industries.

Madras Institute of Technology (MIT) developed the set of Process Modeling tools and Advanced Control Algorithms and C-DAC-Thiruvananthapuram, as the implementing agency, ported, tested, incorporated and validated these algorithms under the ASTeC programme.

Synchronized Phasor Measurement Unit (SPMU)

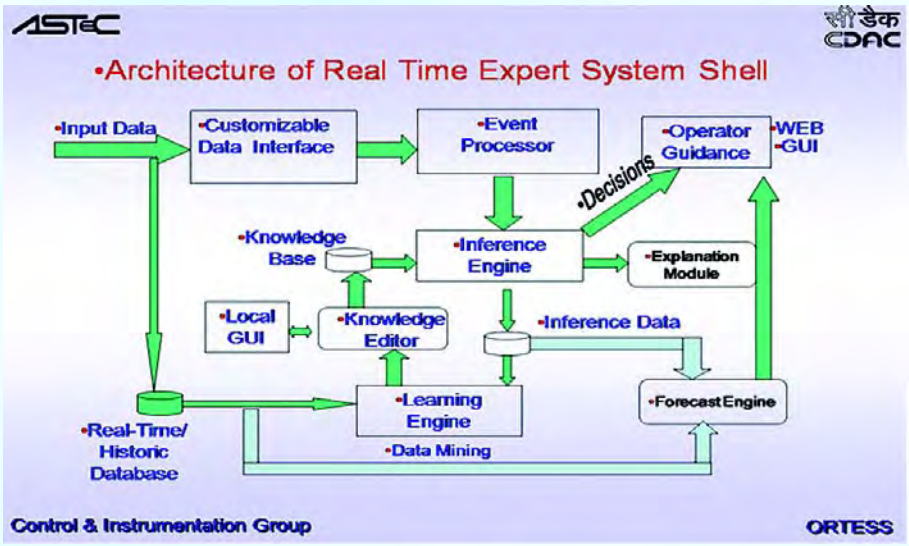
SPMU, suitable for application in Power System Wide Area Measurements and as an interface to SCADA system, has been developed by C-DAC under the ASTeC programme, in collaboration with IIT-B and funded by DeitY. The product finds applications in substations, to monitor electrical parameters for real-time control of power systems. The device measures power system data in real time and reports to the Phasor Data Concentrator (PDC) for visualization, data storage and for running a variety of `on line' and `off line' applications in system analysis and control. The developed PMU fits seamlessly into the existing network. This will enable the system to run economically and will ensure system stability following major disturbances.

It features 6 Voltage and 6 current inputs, sampled at 25.6 KHz rate with GPS based synchronization and time stamping, DFT based Phasor estimation algorithm and External data communication through Ethernet (25 message frames per second as per IEEE standard C37.118-2005). The HMI consists of a front panel keypad and LCD with USB and SD Card Interface. SPMU calculates voltage and current Phasors, frequency and rate of change of frequency. The digital hardware with high frequency multi-core processor and RTOS has been benchmarked with imported PMU. The developed SPMU obtained Environmental testing certification by ERTL, Thiruvananthapuram.

Object based Real Time Expert System Shell (ORTESS)

ORTESS is an integrated software tool which can be used by system developers and domain experts to develop knowledge-based systems. The tool allows creation of knowledge base by encoding an expert's knowledge as a set of rules and frames and infers using built-in backward or forward chaining inference engine. The tool is designed to interface with external SCADA systems via plug-in modules, which support standards like OPC. It also supports explanation facilities. The Learning Engine learns new knowledge from process data and updates Knowledge Base, thus improving the efficiency of the system in root cause analysis. The Forecast Engine does failure prediction, which can help in Preventive Maintenance (PM) of plants. The tool finds extensive applications in developing Intelligent Operator Guidance Systems for Diagnosis and Root Cause Analysis of alarms and faults in process plants.

Intelligent Operator Guidance System for Root Cause Analysis of Gas Turbine Alarms was designed and developed using ORTESS, with PI Client interface for online connectivity and implemented at NTPC's Rajiv Gandhi Combined Cycle Power Plant (RGCCPP) at Kayamkulam, Kerala. Intelligent Operator Guidance System for Root Cause Analysis of Coal Mill System Trouble Alarms was designed and developed using ORTESS and successfully commissioned at Tuticorin Thermal Power Station (TTPS), Tamil Nadu.



Architecture of Real Time Expert System Shell

Autonomic Real Time Multi Protocol Gateway (ARTMG)

It is a real time protocol conversion stack on top of IPV6 for real time data communication. The ARTMG framework can be used to convert proprietary protocol (SINAUT) to IEC 870-5 standards and also to interface ICCP Network of SCADA Control centres. It has an agent based diagnostic tool and uses the agent technology for port management and monitoring various parameters used in SCADA control centres.

Major outcomes of the project are Protocol Converter and ICCP network interface. The Protocol Converter follows IEC 60870-5 101 to IEC 60870-5 104 standard. Proprietary Protocol (SINAUT -8FW PCM) for serial and Ethernet interfaces have also been developed. ICCP Network Interface supports all blocks from 1 to 9 of IEC 60870-6 TASE.2 for both client and server. A user interface to ICCP for user and data management of ICCP links XML technology for data exchange between local application and ICCP system.

Safety Devices and Solutions

Self Recording Image Surveillance System (SRISS)

The system has image processing and image compression algorithms implemented as firmware. A PC-based software to retrieve images, based on pre-defined searchable parameters, and for presenting the stored images in real-time as well as in accelerated real-time format, has also been developed.

The system features an Image Resolution of 320x240 Pixels and Viewing Angle of 58o with a frame rate of 1-16 FPS using JPEG Compression method. Storage is done in 2GB SD Card with USB interface and Power Supply required is 3.3 V only. The developed system serves as a stand-alone surveillance system for applications in the areas of intrusion monitoring, security-oriented surveillance, attendance monitoring, etc.

Distress Call Response Management System (DCRMS)

Distress call management is a key function in any Police Security System. DCRMS automates this function by providing a user-friendly interface for the “Dial 100” facility. C-DAC had successfully deployed “Automated Dial 100 System” in the cities of Thiruvananthapuram, Kollam, Ernakulam, Thrissur, Thalassery, Kozhikode, Bhopal, Indore, Jaipur City and Kolkata.

The Automated Dial 100 system is a turn-key solution developed and implemented by C-DAC to help the State Police to efficiently run a Distress Call Response Management Service (DCRMS) to provide quick response to distress calls and to maintain law and order situation better. Details including the approximate location of the distress caller, are passed on to the patrol vehicle nearest to the site of incidence. The call taker has the option of establishing a voice call with the vehicle and to give guidance to the driver to reach the event spot via the shortest path. Once the vehicle reaches the spot, the police team attends to the distress and then sends a Predefined Status Message for event closure to the Dispatcher.

The system works by integrating state-of-the-art technologies such as Automated Vehicle Locating System (AVLS), Geographical Information System (GIS), Call Taking and Dispatching System using wireless communication. The GUI of the Dispatcher/Call Taker presents a multi-layer vector digital map of the city that can be zoomed upto thirteen levels and supports forty two information layers. The main features of the system are automated call handling using Computer Telephony Interface and intelligent call routing algorithms, Customized phone catalogue and phone address finder, faster despatch, dynamic map generation, better voice communication, digital voice recording, proximate vehicle identification, vehicle monitoring/ tracking, total event history logging, custom report generation and real time alert messages. The main technological highlights are integrated solution, Open Source platform, TETRA/GSM based communication, location updates through GPRS, multilayered digital vector map, GIS based caller/ vehicle tracking, open source operations, AJAX enabled data loading, PSTN Gateway with E1 Interface, echo canceller, etc.

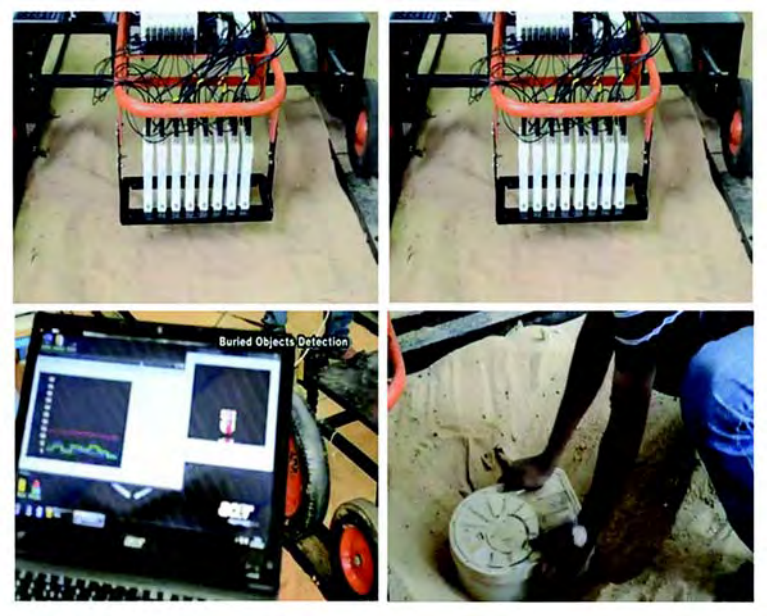
Portable Tetra Base Station for NPOL, Kochi (PTBS 404C)

The PTBS works on TETRA technology. TETRA is a digital professional mobile radio (PMR) standard devised by ETSI and it supports both voice and data communication. The indigenously developed PTBS product brings the digital radio communication advantages to the PMR users in the country. PTBS incorporates the state-of-the-art Multi-Carrier Power Amplifier (MCPA) technology and it can be configured for up to 3 carriers at 2.5 watts per carrier.

It offers simplex, duplex, broadcast and group calls; circuit mode data, and short data services (SDS). It also offers Pre-emption, priority and, emergency calls. It sets up calls faster with interface to any IP network. The system follows full GPS controlled TDMA time slot synchronization. It incorporates security features like Mutual Authentication / Encryption.

The compact design of the PTBS makes it suitable for Vehicle mounting (form factor being 19.5''U).
It can be operated on battery power source. When integrated with a retractable mast and antenna, the PTBS becomes an ideal communication infrastructure for emergency field deployment at disaster struck areas. The indigenous development of the system is expected to bring savings in foreign exchange by way of import substitution.

Portable Ultrasonic Landmine Sensor (PULSE)



Field trial of Portable Ultrasonic Landmine Sensor at the Sand pit

The conventional approach to detect landmines is to use sniffer dogs or metal detectors, or even suicide squads. Relying on metal detection is especially difficult as many of the mines used today have extremely low metal contents. With its experience in developing vehicle mounted detection system for landmines using ultrasonic techniques for military use, C-DAC has pioneered and successfully developed the technology for a low cost, portable, battery-operated landmine detector for civilian applications.

This unique product uses analog mixing techniques instead of the usual digital mixing, for achieving low bandwidth and optimum data clock rate. The non-contact acoustic-sensor based equipment employs robust signal processing and special stabilization algorithms to compensate for the effect of sensor movements to make the visualization of the buried object with more clarity. Efficient ground excitation is done by direct earth exciter and vibration sensing by non-contact ultrasonic sensors.

The product can detect buried objects including buried landmines using Real-time continuous resonance imaging. Any false alarm due to the up-down movement of sensor array is mitigated using stabilization algorithms. Upon detection, the system generates audio and visual alarms and can be controlled through user friendly GUI interface. The system hardware consists of 16-channel DSP based data acquisition, analog mixing with 100Hz to 500Hz frequency of operation. The system provides a ground spatial resolution of 2.5cm and the maximum distance between sensor and ground is 20cm.

Agri-Electronics Systems

E-Vision and E-Nose Systems

E-Vision system, developed by C-DAC, provides rapid, non-invasive, real-time, objective measurement of critical dimensional traits of objects. It has a digital camera based image capturing mechanism and an intelligent image analysis software. It is capable of measuring dimensional properties such as a) Length b) Breadth c) L/B ratio, etc.

E-Nose system, also developed by C-DAC, is an instrument, which comprises of an array of gas sensors and pattern recognition model to discriminate odors by analyzing partially selective gas sensor array data. It consists of (a) sensor array, (b) PC-based data acquisition and (c) olefaction software. E-Nose system can be used for detecting and quantifying the intensity of aroma in a digital form.

These systems have been deployed for:

- Quality assessment of aromatic rice at Regional Research Station (OAZ), Uttar Banga Krishi Viswavidyalaya, D. Dinajpur (West Bengal). Rice Research Station, Chinsurah, had co-operated in its development.
- Quality assessment of spices such as cardamom at National Commodity and Derivatives Exchange Ltd., Hyderabad
- Colour characterization of silk yarns at Professioanl Assistance for Development Action (PRADAN), Deogarh, Jharkhand
- Detection of obnoxious gases at TNPL Pulp and Paper Industry, Tamil Nadu and Rajahmundry Paper Mills, Andhra Pradesh.

Decision Support System for Tea Production using Wireless Sensor Network (WSN)

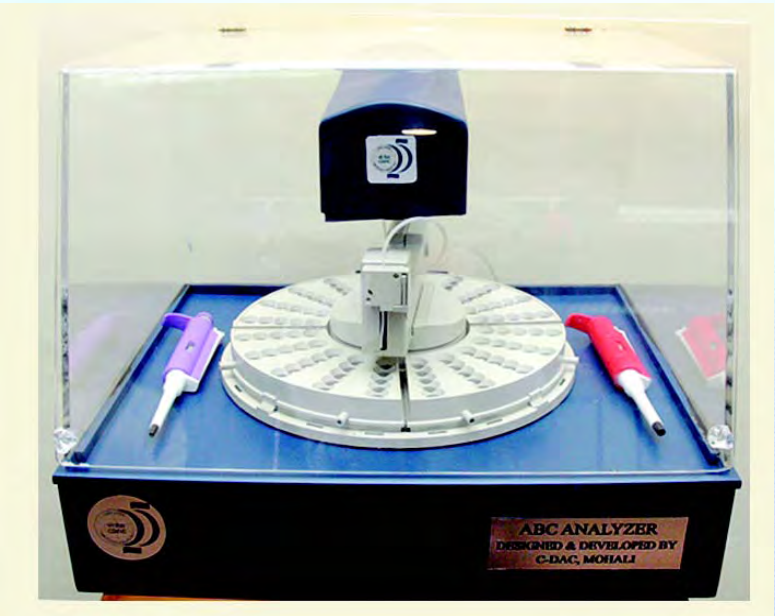
C-DAC developed a WSN based Decision Support System (DSS) for monitoring environmental parameters of Tea Plantation at Tocklai Experimental Station, Tea Research Association (TRA), Jorhat, Assam.

Medical Electronics

Automatic Bio-Chemistry Analyzer (ABC Analyzer)

An automated analyzer is a medical laboratory instrument designed to measure different chemicals and other characteristics in a number of blood samples quickly, with minimal human assistance. The principal of operation of the analyzer is based on Lamberts and Beer's law of photo-chemistry. The transmitted light coming out of a liquid contained in a transparent glass depends upon the concentration (C), path length (T) and intensity of the incident light. Once the technology is developed, indigenous production could save the cost of importing the item.

It features a 100 position auto sampler with OD Range from 0 to 3.0. It requires 300 to 400 µl or even less reagent per sample by designing optical path so that flow cell is closer to sample. It also provides carry over control through Air Purging. With a large Test Data base memory and user friendly interactive software, result could be produced by stamping date, name and ID.



Automatic Bio-Chemistry (ABC) Analyzer

Wireless ECG Sensor

C-DAC has developed a small pocket sized device to wirelessly acquire ECG of a patient by a single lead. The ECG sensor is attached to the patient with two Ag/AgCl electrodes on the left and right side of the chest. The signal obtained from the body is filtered and amplified. The sensor outputs an analog signal which is then sampled by the analog-to-digital converter (ADC) at a sampling rate of 470 samples per seconds. Its input frequency range varies from 0.04 to 33 Hz and claims a CMRR of 130 dB and Gain of 1000. The device operates on 9V battery.

Wireless ECG Sensor

Other Electronic Devices and Solutions

Adaptive Noise Cancellation (ANC) IP Core

Noise cancellation IP core addresses the problem of reduced intelligibility of speech due to signal corruption by additive background noise. The ANC IP core mitigates the adverse stationary background noise that interferes with the normal speech. The developed single channel (single microphone and speaker) noise cancellation IP core can be used as a plug-in module in real-time portable electronic systems. A proof-of-concept Noise cancellation IP core has been implemented in Virtex-4 FPGA with AIC111 as audio codec. ANC provides SNR improvement of 9dB minimum. There is no audible distortion at the output for an input segmental SNR of 2dB and above. ANC gives real-time performance with processing latency within 12.5 ms and supports serial/parallel inputs.

Adaptive Noise Cancellor (ANC) demo platform

Low Power Sensor Motes

These motes are based on SoC Atmega128RFA1, complying with Zigbee-Pro/IEEE 802.15.4, and with on-chip antenna or RPSMA antenna. The motes offer -100 dBm receive sensitivity and transmit output power up to 3.5 dBm. Each mote is an ultra low power consumption device (1.8 to 3.6V) drawing less than 20 mA. Its 2.4 GHz transceiver can be powered from 1.5 V battery or USB. Each mote can be used to capture physical parameters energy-efficiently using appropriate sensor board. The captured data can be transferred using ZigBee to local or remote system using a gateway.

WSN Sensor Boards

Sensor board contains on-board sensors for sensing Light, Temperature, Humidity, and Battery Voltage. The Sensor Terminal Board is a development platform for WSN Mote Hardware. It interfaces RF section with a 2x24 pin Berge Strip Connector and sensors with I2C bus. It also provides analog input ports for current and voltage sources. C-DAC has developed WSN sensor boards compatible with its low power sensor motes.

Multi-Protocol Gateway

These include Zigbee-Pro/IEEE 802.15.4 (2.4 GHz), Bluetooth (with Hardy frequency hopping), USB, Ethernet : 10/ 100mbps port, and Quad-Band GSM/GPRS 850/ 900/ 1800/ 1900 MHz with configurable baud rate. The gateway also provides inbuilt powerful TCP/IP protocol stack for internet. The low power sensor motes, WSN sensor boards and multi-protocol gateway can be used together for various types of applications.

WSN with low power sensor mote and multi-protocol gateway

Software Technologies

In the Software Technology area, C-DAC is spearheading the Free and Open Source Software (FOSS) initiative within the country through its BOSS (Bharat Operating System Solutions) and NRCFOSS (National Resource Centre for Free and Open Source Software) programmes. C-DAC also designs and develops various types of software for e-Governance applications, GIS applications, digital library solutions, and other applications of social impact. The activities carried out by C-DAC in this thematic area during the year are described below.

Free and Open Source Software (FOSS)

BOSS Linux

BOSS Linux 5.0 was demonstrated and presented during the C-DAC Technology Conclaves at Hyderabad and Delhi. BOSS GNU/Linux Desktop edition 5.0 (code named Anokha) features the latest Kernel 3.2.0-3, supports Intel 32 bit & 64 bit architectures, a 3D desktop environment, Graphic installer, Office application software suite Libreoffice 3.5.4, Internet access software (e.g.: web browser, email, chat, etc.), file sharing/converter, and multimedia applications. The new version features a Media center to allow the users to easily browse and view videos, photos, podcasts, and music from a hard drive, optical disc, local network, and the Internet. There is a personal and small-business financial-accounting software to extend the use of BOSS GNU / Linux to SMEs.

Various initiatives for deployment of BOSS Linux on a large number of platforms include the following:

- Efforts to deploy EduBOSS Linux in around 9,000 nodes (in two pilot districts) under EDUSAT project of Govt. of Punjab and deployment of EduBOSS in 65 schools of Pondicherry under SSA
- In Tamil Nadu, BOSS Linux has been deployed in around 8.3 lakhs and 7.6 Lakhs laptops in the first and second phases respectively. BOSS Linux is deployed in 500+ systems in Secretariat Tamil Nadu (across 23 depart ments). Also, Department of Rural Development, Tamil Nadu has released orders for 12500 systems with BOSS Linux as the default OS
- Govt. of Maharashtra has floated a tender for 60000 systems across 5000 schools which includes BOSS Linux as the OS
- Training on BOSS Linux to Govt. officials organised at Vishakpatnam, Hyderabad, Bhopal, Patna and Shillong under initiation from M/s Centre for Innovation of Public Systems, Administrative Staff College of India, Hyderabad

Linux Kernel Programming Plugin Suite for Eclipse IDE (Link Plus)

To address the commonly encountered challenges that developers face, C-DAC is developing an Eclipse IDE plugin suite for Linux Kernel Programming on X86 and ARM platforms that provides the developer with various features such as:

- Kernel configuration and compilation
- Wizard for system call implementation and testing
- Templates for module programming and driver development
- Supported platforms: X86 and ARM
- Support for native and cross platform GNU tool chains
- Integration of QEMU simulator for executing, testing and debugging programs without target hardware
- Integration of basic Root file system development for ARM platform using busybox

Knowledge Based Repository for FOSS in Education

This solution provides a generic portal framework for knowledge repository, which is based on intelligent approaches such as information retrieval and machine learning. The repository contains web documents classified among various classes such as LMS, CMS, Assessment Software, etc. It also contains user experiences for different classes,

and comparative analysis of various tools belonging to respective classes. The portal also has features such as specialised search engine, collaboration facility for community supported content updates, and linkages with recognized forums for dynamic updates. The portal was released for public use on January 30, 2013. It can be accessed from the URL **http://nrcfoss.cdacmumbai.in/sangrah.**

e-Governance Applications and Frameworks

e-Pramaan with Aadhaar

e-Pramaan is a National e-Authentication service offered by DeitY. It provides a simple, convenient and secure way for the users to access government services via internet/mobile as well as for the government to assess the authenticity of the users.

Major Components of e-Pramaan includes:

- Identity Management (including Credential Registration)
- e-Authentication (including Step-up Authentication)
- Single Sign-on
- Aadhaar based credential verification

Aadhaar project of UIDAI provides two services for the residents of India viz. Aadhaar Enrolment Service and Aadhaar Authentication Service. C-DAC has implemented Constellation of Gateways under NeGP. These gateways provide messaging middleware and enable Integrated Service Delivery based on Service Oriented Architecture (SOA) for various government services. A PoC for positioning of NSDG in Aadhaar Authentication Ecosystem was demonstrated by C-DAC to DeitY. C-DAC has become Authentication Service Agency (ASA) and Authentication User Agency (AUA) in this ecosystem. C-DAC has hosted minimal AUA-ASA setup which was used in FRR testing activity of Certification of Aadhaar Authentication Devices procedure jointly carried out by STQC, UIDAI and C-DAC. C-DAC AUA-ASA service was used for FRR testing and is presently being used by various government departments.

State eGovernance Service Delivery Gateway (SSDG)

SSDG acts as a core infrastructure for achieving standards-based interoperability between various e-Governance applications implemented at State level and geographically dispersed locations. SSDG de-links the back-end Departments/Service Providers (SP) from the front-end Service Access Providers, thereby ensuring separation of concerns of service access from the service implementation. This approach also helps the Departments backend workflow evolve gradually as the Gateway acts as a middleware, de-linking the backend from the front end.

C-DAC provides SSDG software product and the optimized SSDG software stack containing Operating System, Application Server, and RDBMS. C-DAC also provides necessary patches, service packs and upgrades of SSDG, technical support for SSDG product and the optimized stack and training to the Implementation Agency (IA) and the state personnel.

SSDG has gone Live in 11 states/UT, namely, Goa, Himachal Pradesh, Puducherry, Uttar Pradesh, Tamil Nadu, Meghalaya, Sikkim, Nagaland, Manipur, Mizoram, and J&K. SSDG deployment is in progress in 8 states/UT, namely Bihar, Rajasthan, Tripura, Assam, Madhya Pradesh, Chhattisgarh, Andhra Pradesh. 563 state level services registered in NSD till date. In Jammu/Kashmir, SSDG is in progress. The state portal and seven G2C services across 3 departments (Social Welfare, Health and Medical, and Employment Exchange) have been completed. Soft-launch of 5 services was done in Ganderbal district and Akhnoor tehsil of Jammu district. The state wide launch of the seven services is being planned shortly.

Mobile Services Delivery Gateway (MSDG)

MSDG (Mobile e-governance Services Delivery Gateway) provides an integrated platform for delivery of government services to citizen over mobile devices using SMS, USSD, IVRS, CBS, LBS, or mobile applications installed on

mobile phones. To leverage the reach of mobile phones and potentials of mobile channels, Department of Electronics & IT (DeitY), Govt. of India, has launched Mobile Seva, a country-wide initiative on mobile governance to provide public services to the people through mobile phones and tablets. Mobile Service Platform would greatly enhance the uniformity of service delivery to end users or citizens. Key features of the platform are:

- Provides multiple mobile based channels (eg. SMS, USSD, IVRS, m-apps) for delivery of public services
- Once integrated to any one channel, provides automatic integration to other available channels
- Allows for hosting / managing a user's own m-Apps on the Govt m-Appstore
- Would be a part of government gateway constellation

Snapshots of Mobile Service Platform

Electronic Project Proposal System (e-PPS) for DeitY and ICMR

The Electronic Project Proposal System (e-PPS), developed by C-DAC for DeitY, is a web-based system that encompasses the complete life-cycle of funding of R&D projects, beginning with online submission of project proposals for funds, to monitoring and management of funded projects.

e-PPS replaces the existing manual system of project funding, wherein the Project Investigators (PI) submit hard copies of R&D proposals, which are presented to a Working Group and based on the recommendations of the Working Group the proposals are further processed in DeitY.

It is a One-Go Dash-Board to see the projects from initiation to completion. It reduces the total processing time of proposals and aids easy dissemination of project information. Key features include:

- PKI infrastructure to secure proposal submission and evaluation process.
- Supporting an integrated communication model for seamless communication among relevant users.
- Supporting an automated e-mailing system for various requests, alerts and reminders.
- Supports role based access to each user.
- Supports the complete life cycle of the project from submission to conclusion, including project monitoring.

A similar system has also been developed for Indian Council of Medical Research (ICMR). The system is operational since January 1, 2012. As on April 30, 2013, there are 2548 pre-proposals (1st stage submission) and 782 full proposals (second stage submission) on the system. Also, there are 789 experts registered on the system.

Electronic MSIPS Application System (e-MSIPS) for ESDM Standards

e-MSIPS is a web-based system for the online submission of applications under the M-SIPS scheme. Users wanting to take benefit of the MSIPS scheme can submit their applications online on the system. These applications will then be scrutinized online by committees of experts, and based on the recommendations of the committees, incentives will be granted through the system.

Shri Kapil Sibal, Hon'ble Minister for MC&IT, launching e-MSIPS

e-MSIPS replaces the existing manual system of submitting M-SIPS applications in hard copies to the nodal officer, which are processed by the DeitY and presented to the appraisal committee for approval of incentives. Key features include:

- Digitally signed applications by all the relevant stakeholders
- Supporting an integrated communication model for seamless communication among relevant users
- Supporting an automated emailing system for various requests, alerts and reminders
- Supports role based access
- Supports the complete life cycle of the project from submission to conclusion

The system was launched by Shri Kapil Sibal, Hon'ble Minister for MC&IT, on March 25, 2013.

Few Other e-Governance Applications

Few other e-Governance applications that C-DAC developed or carried out development work during the year include:

- **System for dairy development department of Kerala:** The system enables farmers to get details about the various support and development schemes intended for them and the status of the complaints registered by them as SMS alerts. The officials at various levels, with proper authorization, can access relevant information via the web based solution. Integration of the activities of the department, by linking the various offices geographically distributed across the state, will provide useful information to the dairy farmers in their local language, Malayalam.

- **Online Recruitment Management System (ORMS):** It is a web based solution being developed by C-DAC for addressing the recruitment needs of Rubber Board, Govt. of India, Kottayam. The application will be hosted by C-DAC and made available to Rubber board as SaaS model. The product will handle all the activities of recruitment process for Rubber Board.

- **Asset Management and Tracking System (AMTS):** It is a web based system for managing and tracking the location of assets. The primary goal is to build a tracking facility for Data Center Assets. The complete asset life

cycle is monitored using this solution. Wireless technologies like RFID and WSN are used to implement the asset tracking functionality. It offers a centralized facility for different user groups to monitor the current asset status and location of the assets owned by them. AMTS is a platform independent, browser based application.

- **System for registration of electronic and IT goods for DeitY:** C-DAC is developing a system for DeitY to streamline the process of compulsory registration of electronics and IT goods. The system will help manufacturers submit their product registration applications. The approved applications will be provided the ISI certification. Further, all ISI certified products will be verified by DeitY. All these processes will be supported by the system.

Geographical Information System (GIS)

National Level Database for Geomorphology and Lineament Mapping for Bihar

C-DAC as a partner institution has taken up the initiatives to map geomorphology and lineament on 1:50,000 scale using Remote Sensing (RS) technology in collaboration with Indian Space Research Organisation (ISRO) and Geological Survey of India (GSI) under National Resources Repository (NRR) activity for the entire state of Bihar. Under this project, geomorphology and lineament map are prepared using IRS LISS-III satellite data and limited field check.

The geomorphological and lineament maps prepared will find application in various fields of activities such as environmental studies, integrated land and water resources development, disaster mitigation and management, ground water exploration and hydrology, mineral exploration, geo-engineering and seismo-tectonic studies.

GIS enabled Road Information Management & Monitoring System (GRIMMS)

The objective of GRIMMS is to provide GIS interface to the On-line Monitoring and Management System (OMMS) and manage various activities under 'Pradhan Mantri Gram Sadak Yojna (PMGSY)' for Tripura, Mizoram and Odisha. PMGSY (Pradhan Mantri Gram Sadak Yojna – Prime Minister's Rural Road Programme) was launched by the Govt. of India to provide road connectivity to unconnected rural habitations. The web-based GIS (GRIMMS Web) can be accessed from http:/omms.nic.in/grimms.

Salient features of the system include efficient and user friendly application, efficient management and monitoring of rural roads, project monitoring in space and time, decision making through objective analysis, information about government plan regarding construction / updating of roads, more transparency in system, and free access on the site for the public. Work is being planned to extend this system for Sikkim.

Digital Library Initiative

A major activity of the Digital Library Initiative of DeitY, MCIT, Govt. of India is being implemented through a Regional Mega Scanning Centre, established in C-DAC since 2005. The work involves digitization of Rare and Copyright free Books & Manuscripts of Eastern and North-Eastern part of the country. Under this initiative, the 2nd Phase work is going on and as of now, over 28 Million pages have already been digitized from over 68,000 Rare and Copyright Free Books by installing Overhead Book Scanners at different libraries of West Bengal.

Recently, DeitY sanctioned another project extending the digital library activities for all North Eastern states of the country. The aim of this project is to create a portal of Heritage Books and Manuscripts of India, which will foster creativity and free access to all human knowledge. As a first step in realizing this mission, it is aimed to create the Digital Library with a free-to-read, searchable collection of one million books, predominantly in Indian languages, available to everyone over the Internet. This portal will also become an aggregator of all the knowledge and digital contents created by other digital library initiatives in India. The result will be a unique resource accessible to anyone in the world 24x7, without regard to socioeconomic background or nationality. Already uploaded books are available at http://www.dli.ernet.in.

Other Software Systems and Solutions

India Development Gateway (InDG)

The objectives of the Phase II project of InDG was to expand the scope of InDG in terms of the information, products and services delivery to the rural communities, customize and integrate Open Source Software tools for applications that facilitate rural development and strengthen the capacities of the content consortiums of InDG for effective generation of relevant content.

Four more languages (Assamese, Kannada, Malayalam and Gujarati) were added to earlier six languages (English, Telugu, etc.) and one vertical (Social welfare) was added to the earlier five verticals (education, agriculture, etc.) to the InDG portal – www.indg.in. Several products and services in the areas of Agriculture, Education, Health and Rural energy were conceptualized, developed and piloted during the project period. The concept of State Resource Groups was piloted in the states of Andhra Pradesh and Tamil Nadu.

The Phase III project of InDG aims to build on the foundation laid down through its earlier phases to scale-up to all states, in all Indian major official languages (22) and all domains relevant to the poor and the vulnerable.

Anumaan: Predictive Writing System

Anumaan is an open source on-screen predictive text entry system. It provides predictions based on preceding text/words used by the user in his/her text and user can use these predictions, while composing text. By incorporating predictions, a user can improve his/her rate of text entry to a great extent.

Anumaan is mainly intended to help persons with motor disabilities, especially those facing problems in hand and finger movement. Such persons face difficulty in using regular input devices like keyboard for text entry related tasks. Anumaan can help them immensely in their text entry tasks by way of predictions. However, It is equally useful for common users also and can support them in creating mails, letters, documents, etc. in less time.

Gestures with Mouse (GEM)

GEM (GEstures with Mouse) is an input mechanism which uses gestures as input to the system. Gestures (single part or multi-part) can be drawn using a mouse or some equivalent device such as touch pad, joystick, pen tablet, etc. This input mechanism is intended for people suffering from different kinds of motor disabilities, who may face problems in using mouse and keyboard in conventional way. Hence, it provides them with an alternate and effective mechanism for using the system to perform various tasks such as navigation, executing commands and keyboard shortcuts, and launching applications etc. on Linux desktop. DEB and RPM packages of GEM were released on December 24, 2012. GEM can be accessed at http://gem-cdac.sourceforge.net/.

Ethiopian Customs Valuation System (ECVS)

ECVS is a decision making software tool to assist customs officers in determining whether the price of a commodity declared by an importer or exporter is within permissible range or not. ECVS maintains the contemporaneous price reference database and provides an estimate of the price for a given commodity.

Intelligent Advisory System for Farmers (IASF)

The existing agriculture extension services can be improved by integrating IT and mobile services. Sharing of knowledge among experts, farmers, students and research scholars are very important for the growth of agriculture sector. The farmers' queries are stored along with its solution (called CASE) in database. A farmer can ask a question related to the farming activities supported by IASF and the system produces a highly probable solution from a large database containing collection of queries and expert opinions given on them. IASF is a self learning system that acquires new problems and corresponding solutions. The system can help farmers on time in physical absence of agricultural experts. IASF and IASF Mobile Service were relaunched on August 13, 2012. Seven IASF access points were opened

during the launch. IASF for Meghalaya was launched on the November 29, 2012.

Navigation System for Visually Impaired

The objective is to enable a visually impaired individual to navigate using speech based instructions. This involves site survey and implementation of various algorithms for current position, path planning and navigation. Technologies such as Wi-Fi fingerprinting on centralized server and position sensor on mobile are used in the implementation. It is designed to train and deploy in any indoor environment. The end-user module is suitable for any Android hand held device.

ALViC (Accessible Linux for Visually Challenged)

ALViC is a complete desktop environment which provides a comprehensive solution for visually challenged users. This is a GNU/Linux distribution based on Ubuntu 10.04, and uses Orca 3.2.0 x desktop screen reader as the main interaction mechanism for visually challenged users. Visually challenged users can use readily because accessibility features suitable for fully and partially blind users are enabled by default.

ALViC being used by a visually challenged person

ALViC was launched on February 11, 2013 by Prof R. Chidambaram, Principal Scientific Adviser, Govt. of India and Shri J. Satyanarayana, Secretary, DeitY, Ministry of Communications and IT, Govt. of India, during the second C-DAC Technology Conclave at New Delhi.

Cyber Security and Cyber Forensics

Cyber Security and Cyber Forensics is another thematic areas of C-DAC. In this area, C-DAC is involved in development of various types of technologies for information security such as Cryptography, Steganography, Intrusion detection and prevention, Cyber Forensics, End system security, Malware prevention, Biometric based identity management, Security solutions using reconfigurable computing, Honeynets / Honeypots, PKI , and Mobile security. In addition to the above, C-DAC also has been conducting training and awareness programs in cyber security and cyber forensics.

Cyber Security

Network Security Solutions

EDGE (Enterprise Wide Self-Managed Network Solution)

EDGE is a web based indigenously developed network management and monitoring solution, capable of managing LAN & WAN. EDGE is a unique product compared to the existing commercial and open source solutions, which integrates the outcome of two different network monitoring sources called SNMP & Flow, and analyses it from security and QoS perspective. EDGE can be configured to take network management decisions at Layer 2 and Layer 3 to protect the network from attacks based on the analyzed output of the network monitoring parameters.

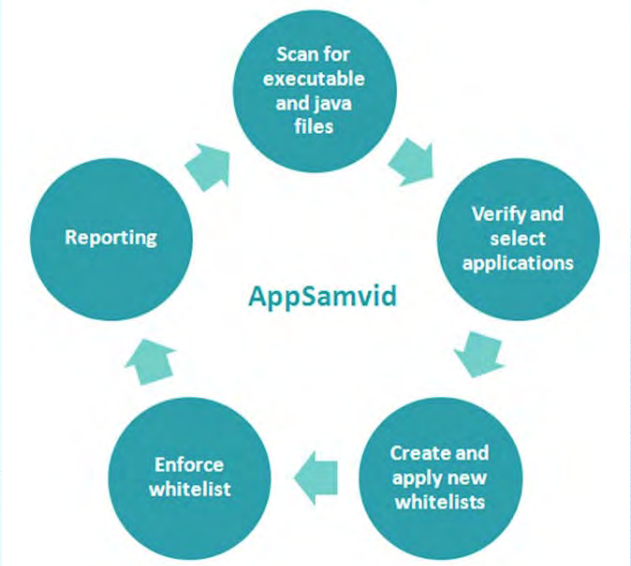
Chakra: A Dynamic Firewall Solution

Firewalls play a crucial role in blocking unauthorized access, while at the same time permitting authorized communications, based upon a set of rules. Most firewall implementations that exist are static in nature where rules are preconfigured. Static firewalls have limitations because they do not keep track of the attacker's information and do not take into account the actions inferred through other defence mechanisms.

Chakra is a dynamic firewall solution developed by C-DAC with capabilities to learn new firewall rules and self-configuration capabilities. It is capable of carrying out multi-event analysis and can perform validation and consistency verification of firewall rules.

End-System Security Solutions

AppSamvid



Schematic of AppSamvid

AppSamvid is an application white-listing solution. Application white-listing is a technique wherein the applications running on a system are monitored and it allows execution of only those applications which are white-listed. In contrary to black-listing approach (which maintains database of malware signatures) used by antivirus software, white-listing approach maintains database of only white-listed applications. Application white-listing has capabilities to address zero-day malware threats through unknown executables. This approach also eliminates the need for continuous updating of database as done in signature based anti-malware solutions. AppSamvid is a centralized white-list management and reporting system that supports white-listing of executables, Java classes and Java archives. It is available in standalone and enterprise versions for Windows environment.

URL Analyzer (Based on Static & Dynamic Analysis)

URL Analyzer is a tool for certifying URLs. It is developed as spin-off product as part of Client Honeypot. Client Honeypot is an active security device in search of malicious servers that attack clients and it is focusing on web browser. URL Analyzer is part of web client honeypot, which includes two components (a) UAC (URL Analyzer & Classifier) and (b) Certifying URLs.

Security Solution for Mitigating Threats from USB Mass Storage Devices

USB Mass Storage devices are useful to an organization and hence should not be blocked. Sometimes USB devices are the only solution to the problem of data sharing. But these portable devices also pose various threats like unauthorized usage of these devices, moving data without the knowledge of the organization and malware easily enters into the organization's computers. USB Pratirodh is used to control the access to USB mass storage devices. This solution is successfully sold to 6 organizations, 1000 CDs were distributed and around 500 members have downloaded from website. Enterprise version of USB Pratirodh software is developed and standalone version is strengthened with additional features.

Authentication and Identity Solutions

Sec-Key D

Sec-Key D is an Efficient Key Distribution Protocol for Critical Infrastructure security protocol (such as DNP 3) and it is based on challenge-response mechanism. Existing industrial communication protocols have no inherent security features. Its key features include:

- Secure mutual authentication of client and server
- No transfer of session key on open channel nor installed manually
- Distribution key is generated at both end nodes
- Ensures the freshness of message
- Symmetric key is passed from server to client by using session key automatic key updation (revocation)
- No third party involvement

BharatiyaAFIS Suite™ (Bharatiya Automated Fingerprint Identification System)

BharatiyaAFIS Suite™ has more than 10 Biometric products, many of them are operational in the field. C-DAC has 06 patents (filed) on BharatiyaAFIS Suite™. Its key features include:

- Improved accuracy and high-performance fingerprint identification
- Full compliance with International Standards, viz. ISO/IEC 19794-2:2005, ISO/IEC 19794-4:2005, ANSI INCITS 378-2004, ANSI/NIST–ITL 1-2007, ILO-SID
- The high precision is achieved with the help of fingerprint's Level III features (pores, ridge contours, edgeoscopic features: the intricate details of the friction ridges).

Bharatiya-IRIS (Bharatiya Iris Recognition and Identity Solution)

Bharatiya-IRIS is a high performance Iris Recognition System for UIDAI and various other Government and Security agencies. Its key features include:

- The system is fully interoperable and compliant to International Standard: ISO/IEC 19794 – 6:2011
- Equipped with a multi-layered robust quality assessment scheme, which makes this end-to-end identification solution highly suitable for non-ideal situation / environment (as in our country)
- Enables identification of persons with spectacles, persons from distance and wide gaze angles, etc.
- This mutli-platform (Windows, Linux) system is deployable over a wide spectrum of devices
- The system is inherently designed to get plugged with other existing biometric solutions/modalities (Multi-modal Biometric System). The packaging scheme typically includes: .JAR, .DLL, .SO, .EXE, etc.

Bharatiya Iris Recognition and Identity Solution

Face Recognition System

This is an ntegrated software which can identify a person from his / her facial image. It has different potential applications like Access Control, Law Enforcement Application, Airport Security, Sieving Duplicate Entries from Electoral Roll, and Missing Person Enquiry. Its key features include:

- Matching is based on only one image present in the database
- Facial signature is calculated based on textural and shape features
- One-to-many searching
- Interactive user interface and ease of operation
- Single and/or batch mode enrolment
- Searching time - 6 to 7 seconds
- Can cater ±20º pose variation, 20% of relative illumination variation and expression variation within a limit
- Can cater unlimited database size
- Compatible with any Oracle, SQL server, MS Access databases

Facial Feature Extraction and Human Behavior Analysis for a Dialogue System

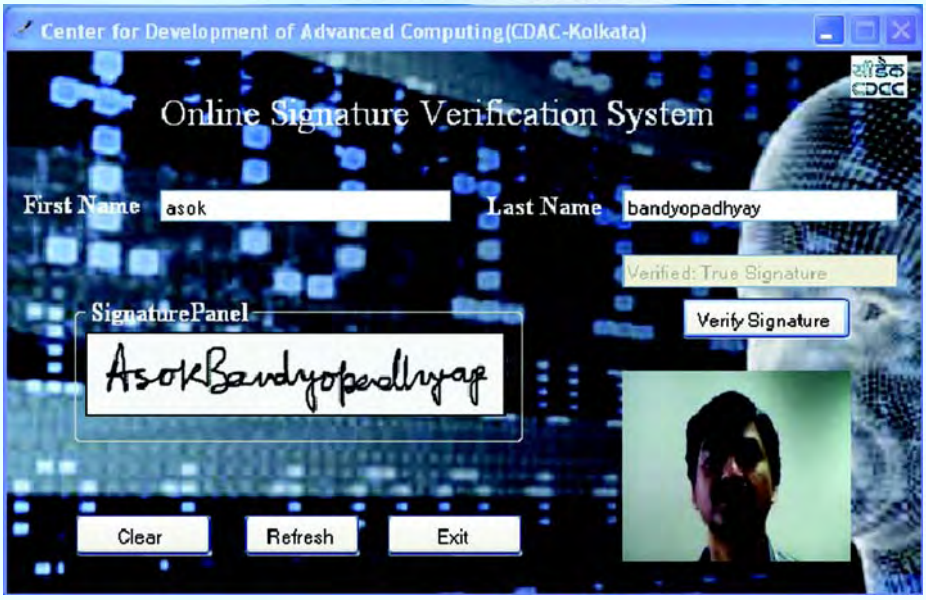
This system implements a Facial Expression Analysis (FEA) Engine that recognizes the six basic prototypic facial expressions, namely Happiness, Surprise, Disgust, Fear, Sadness and Anger from image sequences (irrespective of age and gender). Key features are Facial Expression Analysis Engine (FEA) to identify six basic prototypic emotional facial expressions. Along with this, it has an Annotated Facial Expression Database (FED) of subjects from Japanese and different Indian Ethnic Groups.

Online Signature Verification System for Biometric Person Authentication

Online handwritten signature verification is one of the most popular behavioral biometric methods for inventory, access control systems, airport kiosks, nuclear facilities, etc. This system provides its end users a robust facility for

online signature verification. The purpose of the Online Signature Verification Software is to store online signatures in the form of raw signature data, to perform pre-processing for individual contributors, to derive the local, global and normalized features, to store signature ink images, supervised learning of the signature data through classifier and setting the threshold for each individual. Finally signature is matched to the reference database to generate the proper output. Key features of such a software developed by C-DAC include:

- Average recognition accuracy is 76%
- Takes online signature using tablet and stylus
- Captures real-time raw signature data in terms of biometric features
- Stores images of the signature for offline signature verification
- Provides signers image for person authentication
- User-friendly software
- Modification facilities are supported for wrong entries
- Output interface reflects results for genuine signatures



Online Signature Verification System

Cyber Forensics

Forensic Image Recovery Tool [FIRT]

FIRT retrieves zip files containing picture files. It filters images based on the amount of skin tone content. FIRT can also carve fragmented bitmap files. The tool extracts list of compression and encryption software installed in the system. Indigenously developed cyber forensic tools possessing the above features are not readily available in the country. Forensic Image Recovery Tool (FIRT) is developed and it is capable of retrieving picture files from evidence disk. This tool will help the law enforcement agencies of the country in combating cybercrime menace effectively.

Design & Development of Cyber Forensics Application for Hybrid Architecture based HPC System [CFAHPC]

C-DAC is developing an application with the capabilities for Multiple keywords search in huge data storage media (2 to 5 TB), Cracking of passwords of password protected files, Breaking of keys of encrypted volumes of storage media, and Carving of various files from huge capacity storage media. For better performance, the applicaton will be ported on Hybrid Architecture based HPC Systems.

Training and Awareness Initiatives

Setting up of Lab Infrastructure & Training

C-DAC has setup advanced Cyber Forensics training facilities for North Eastern (Assam, Tripura, Sikkim and Meghalaya) police departments. As part of this initiative, along with the basic IT infrastructure such as Desktop Computers, Server, LAN & UPS, specialized Cyber Forensics hardware tools such as Forensic Workstation (FRED), Write Blocking Device (TrueImager), latest versions of software tools such as EnCase, CyberCheck and Network Forensics Tools (Netforce Suite) are provided and four laboratories have been setup for the police departments of Assam, Tripura, Sikkim and Meghalaya respectively. Mobile Forensics tools such as Cellebrite UFED and Mobiledit were also installed. A total number of 1232 Police Officers/ Staff-members were trained in these states. Advanced level training programmes were specially designed and conducted for 15 days. Computer Forensics and Mobile Forensics were discussed in detail and practical cases were given to the trainees to analyze using laboratory tools. In all the laboratories live cases are being handled by the trained staff.

C-DAC has also setup Cyber Forensics lab infrastructure and training facility for Guwahati High Court and its outlying Benches, High Court of Meghalaya, High Court of Tripura and High Court of Manipur, covering all seven north eastern states (Assam, Manipur, Meghalaya, Tripura, Nagaland, and Arunachal Pradesh, Mizoram).

Multimedia Based Content for Cyber Security Awareness

This project involves design of security awareness material related to Broadband Security, Desktop Security, Mobile Security, USB Security, Phishing, Modem security and Credit/Debit card Security.Security awareness brochures on Broadband Security, Desktop Security, Mobile Security, USB Security, Phishing, Modem security and Credit/Debit card Security are designed in 8 languages. C-DAC has also developed twenty five 2D and 3D animation videos on different cyber security concepts with guidelines and instructions. Additioanlly, C-DAC designed and hosted multilingual website www.secureelectronics.in and it is presently available in 6 languages including English covering cyber security awareness.

Health Informatics

C-DAC has built core competence in the area of health informatics and explored diverse areas to provide efficient healthcare solutions to the citizens of India. The objective is to enable offering of better healthcare services to our citizens through the use of Information and Communication Technologies (ICT). The activities carried out by C-DAC during the year in this thematic area are described below.

Telemedicine

Mercury™ Nimbus Suite

During the year, C-DAC has been working towards adding yet another product in the stream of Mercury™ telemedicine products. The product called Mercury™ Nimbus Suite, will enable deployment of EHR (Electronic Health Record) and Telemedicine services over cloud infrastructure. It is being designed to contain components specially tailored to cloud/clustered infrastructure, include cloud set-up for a comprehensive EHR framework, a maintenance-free cloud repository, and a native Android based client application for accessing Mercury™ Nimbus services.

The Android application will allow specialists to view patient's EHR using smart devices such as Tablets, Smart Phones, etc., monitor cases remotely and provide opinions and advices. The solution, when ready, will provide centralized disaster recovery management in cloud infrastructure providing safety in case of damage at sites. It will reduce the cost of ICT infrastructure due to virtualization infrastructure in cloud, reducing overall cost of the telemedicine network. It will facilitate users to choose among desktops, laptops, or even handheld devices based on Android to access telemedicine services, increasing mobility.

Telemedicine at Gram Panchayats

The main objective of the two projects done under this initiative was to provide basic health facilities to the rural people at Panchayat level.

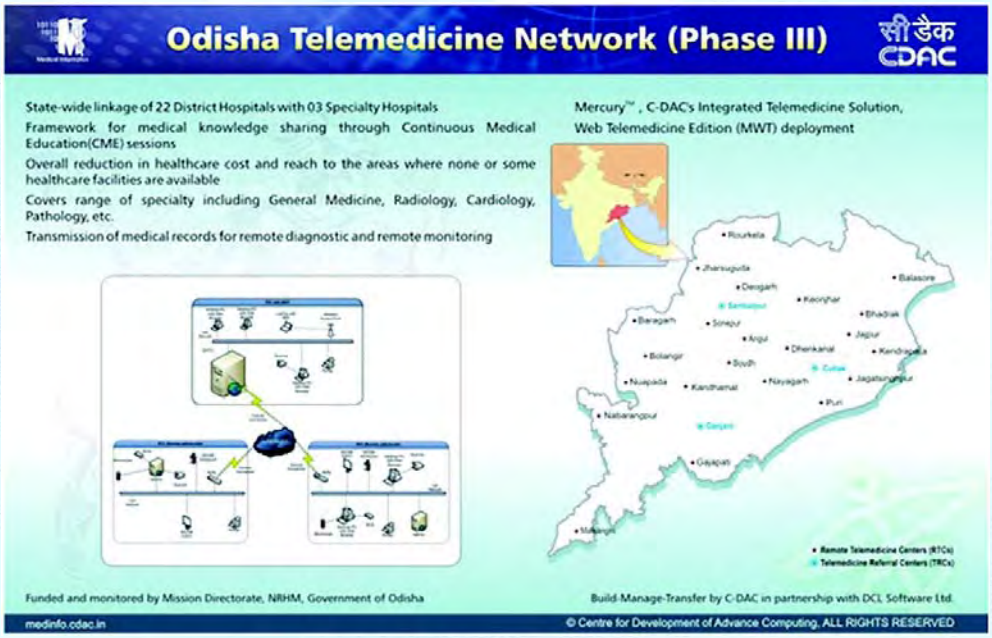
The first project dealt with the deployment of telemedicine infrastructure at ten Gram Panchayats and at two major hospitals in district Ajmer, Rajasthan. Basic medical equipment has been supplied and training to healthcare staff (ANMs and GNMs) has been imparted.

The second project dealt with the deployment of telemedicine facilities at the Panchayat level in blocks at Arian, Parwada and North Tripura. The remote PHC's/CHC's identified under the project were linked to the respective specialist hospitals. The telemedicine equipment and software developed by C-DAC are deployed under these projects.

Extension of Telemedicine Network (Phase-III) in Odisha

After successful implementation and operation of the project for setting up of Telemedicine Network (Phase-III) in Odisha, National Rural Health Mission (NRHM), Odisha entrusted C-DAC with the responsibility of adding three more sites to the existing network. These new sites include one specialty site at State Institute of Health & Family Welfare (SIH&FW), Bhubaneswar and two periphery telemedicine sites at District Headquarters Hospital, Sambalpur and District Headquarters Hospital, Khurda. The extended project will follow the Build, Operate, Transfer (BOT) model for implementation and operation.

The objective of the project is to offer better healthcare reach in extended number of sites in the state of Odisha. Usage of telemedicine services has helped minimize patient travels from rural areas to specialty hospitals and has made specialty care available at remote hospitals.



A schematic of Odisha Telemedicine Network

Revival of Himachal Pradesh Statewide Telemedicine Network

The project objective is to revive the Statewide Telemedicine Network setup earlier by C-DAC in Himachal Pradesh by using the already available state-of-the-art infrastructure supplied under an earlier project titled "Customized Development and Implementation of Telemedicine Application for Rural and Remote Areas of Himachal Pradesh". The old desktop Telemedicine solution is being upgraded with the web-based Telemedicine solution eSanjeevani™. The project is funded by Directorate of Health Services, Department of Health & Family Welfare, Government of Himachal Pradesh.

m-Health

Mobile based Surveillance Quest using Information Technology (MoSQuIT)

The objective of the project is to design and develop a Disease Surveillance System for Malaria using mobile platform. The system will help keeping vigil over the status of Malaria and identify potential outbreak, particularly in tribal and hilly areas, which are often inaccessible. This will enable quick information proliferation, thereby facilitating initiation of timely action by Public Health System. This project started in May 2012 in collaboration with Regional Medical Research Centre (RMRC), Indian Council of Medical Research (ICMR).

The ubiquitous mobile phone is used to collect data from the villages, and transfer to the server located at RMRC, (ICMR), Dibrugarh. A pilot prototype deployment of MoSQuIT has been completed, along with training on the field to the Accredited Social Health Activist (ASHA) workers and RMRC (ICMR), Dibrugarh team.

mSwasthya

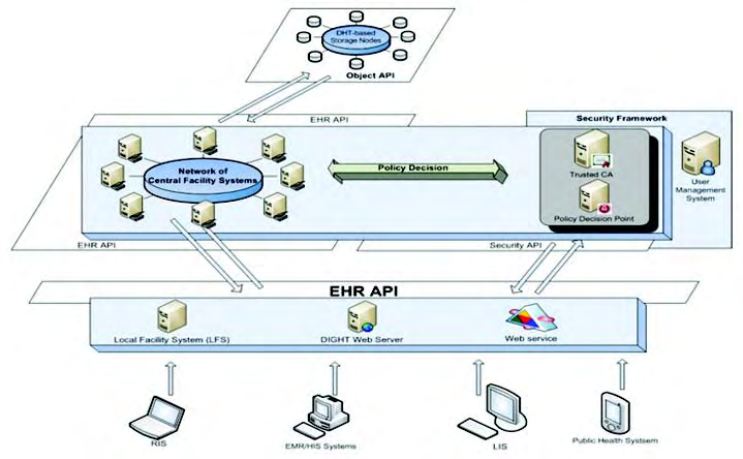
mSwasthya is an android based application, designed to send healthcare alerts to Healthcare Providers and Patients. The developed solution integrates data from the body sensors for different vital parameters such as ECG, blood pressure, pulse rate and body temperature and transmit it directly over to the doctor. The patients can see the trend charts for their health status and seek on-the-fly consultation with the doctors. Doctors can see trend charts to monitor the health of the patient. For any abnormality recorded beyond a threshold value, alerts are sent immediately to the doctor. This application is designed to support dual interface Base Station to transmit the Body Area Network (BAN) data to the Internet using GSM network.

Electronic Health Record (EHR)

Distributed, Scalable, and Reliable EHR Store

This project was initiated in January 2009 in collaboration with Swedish Institute of Computer Science (SICS), Kista, Sweden. The objective of this project was to architect and develop technology / mechanisms / framework that can be used to build a distributed, scalable, and reliable healthcare information store system having a single Electronic Health Record (EHR) for every individual of a nation. The project was successfully completed in December 2012.

The framework developed under this project provides a platform for integration of health record from all possible sources. The framework provides an EHR API, which application developers can use to build services around the framework, and use distributed healthcare store for the storage of electronic health records. C-DAC contributed to the project through its expertise in EHRs, standards, and security, whereas SICS contributed to the project through its expertise in distributed storage.



Schematic of the distributed, scalable and reliable EHR store

The developed framework offers aggregation of health records from existing HIS/EMR systems maintaining unique EHR of patients. This solution facilitates seamless patient referrals during treatments across different healthcare facilities. The developed solution caters to the needs of small clinic setups to interconnection of healthcare facilities at all levels of deployments.

Voice Enabled EHR Management System

C-DAC has developed a voice-based system for EMR data transaction enabling ease of usage to the medical practitioners during EMR/EHR system management. The system uses voice as an input modality, which proves to be cost effective in terms of its ability to substantially reduce the amount of time spent during EMR data transaction as compared to the conventional text entry mechanism.

Preliminary assessment of the system deployed at Clinical Pathology Laboratory, Medical College Hospital, Thiruvananthapuram, reveals satisfactory performance at par with the acceptance criteria put forward by user community. The application supports voice commands as input modality for a variety of EHR management routines such as database searches, queries, form filling, charting, prescription writing, aftercare instructions, order entry, clinical documentation, etc., with word level accuracy of about 85%.

Software for Medical Records Library

C-DAC is developing a software package for the Medical Record Libraries (MRLs) for hospitals under Directorate of Health Services (DHS), Govt. of Kerala and also for the Medical Records cell in DHS. The software collects and maintains the medical records/case sheets of all patients admitted in the hospitals and the health centres under DHS.

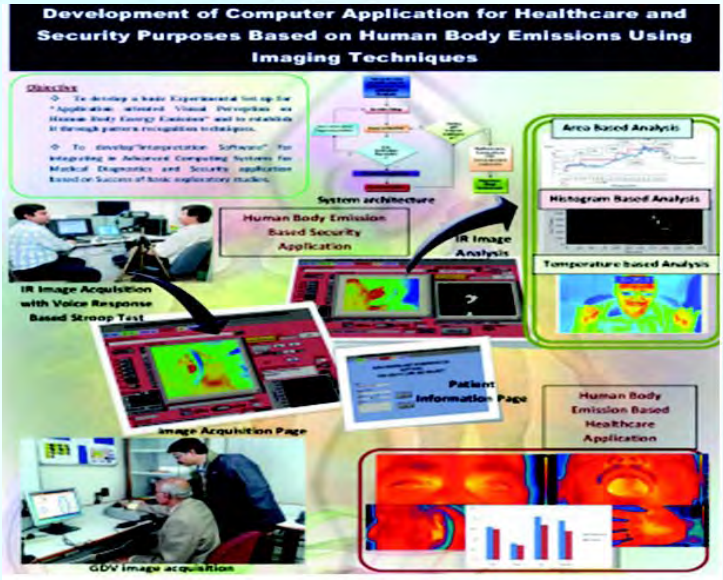
It records the details of patients attending Out Patient (OP) clinics, casualty and In-patients as well. The MRL is expected to bring about marked improvements in patient care and management of medical records.

Medical Imaging

Human Body Emission Based Software for Medical Diagnostics and Security Applications

C-DAC is developing a human body emission based software, which will be useful in medical diagnostics and security applications. The project aims to develop a basic experimental set-up for establishing Visual Perception on Human Body Energy Emission through pattern recognition techniques. Based on the results of the experimental set-up, interpretation software for medical diagnostics and security applications will be developed.

The project includes acquisition, processing and analysis of Infra Red (IR) images and sound, integration of imaging with sound and PPT slide movement, patient database control, integration with online and offline data, and data analysis and interpretation. The developed system will also involve different operations related to imaging such as preprocessing, geometric pattern learning, extracting Region of Interest, feature extraction, noise reduction, etc. Additionally, for medical diagnostics applications, it will include clinical test report recording, ambient temperature recording, and Gas Discharge Visualization (GDV) image capturing.



Schematic of human body emission based software

Medical Image Analyser for Cervical Cancer Prescreening [AutoPap]

The project aims at developing an efficient, reliable and cost effective medical image processing system for analyzing and investigating the cervical smear images. The project is being executed in collaboration with Swedish Research Council (Centre for Image Analysis), Sweden. The proposed solution will be cost effective and most suitable for cervical cancer screening, providing better service to cervical cancer prevention by detecting and treating early abnormalities, which, if left untreated, could lead to cancer in the cervix leading to death.

Analyzer Tools for Medical Domain

Medical Document Semantic Analyzer [MEDSA] Tool

C-DAC has developed a Natural Language Processing system in medical domain that automatically extracts clinical concepts from narrative documents in medical domain such as medical texts, medical guidelines, clinical reports, etc. It uses patient data modeling based on HL7 and Clinical Document Architecture (CDA) to support semantic interoperability. It also uses technologies like General Architecture for Text Engineering (GATE), Unified Medical Lan-

guage System (UMLS), Medical Lexicon Dictionary, and a database of lexicographic biomedical information for use in natural language processing.

EEG Analyzer for Neurological Disorder Detection

C-DAC is developing an EEG analyzer tool for automatic analysis and interpretation of long-term EEG data to detect neurological disorders, such as epileptic seizure. EEG analyzer extracts neuro-physiologically meaningful parameters from long term EEG data by applying advanced digital signal processing algorithms along with machine learning techniques. EEG analyzer detects abnormalities such as epileptic spikes/regions by performing different operations such as Data Acquisition, Preprocessing, Feature Extraction and Abnormality Detection.

The system is a stepping-stone for the future development of epileptic seizure detection and prediction device and a brain computer interface system. It can help researches in the field of Dementia, Schizophrenia and Alzheimer's disease. The proposed system, when complemented with Telemedicine applications, would be very valuable in areas where medical resources and trained clinicians are seriously lacking.

Other Initiatives for Better Healthcare

Healthcare Knowledge System for North-East States

The project was initiated in 2011 under aegis of DeitY to promote public health awareness and IT-enabled health education in all North-East States of India. The developed Healthcare Knowledge System provides a new experience to human cognition for quick understanding of Diseases, Symptoms, Prevention, Diets, Diagnosis, Symptoms Checking and Treatments.

The Health Care Knowledge System has been deployed at the following NE states:

- Nagaland (H&FW Department, Govt. of Nagaland; Naga Hospital, CMO office, Kohima; Paramedical Training Institute, Kohima; Dimapur District Hospital; Christian Institute of Health Science and Research Centre, Dimapur)
- Arunachal Pradesh (Arunachal State Hospital; Arunachal Medical Council, Naharlagun; Ramakrishna Mission Hospital, Itanagar)
- Manipur [Regional Institute of Medical Sciences (RIMS), Imphal; Jawaharlal Nehru Institute of Medical Sciences (JNIMS), Porompat]
- Mizoram (Civil Hospital, Aizawl; Health Dept., Govt. of Mizoram; Regional Institute of Paramedical and Nursing Sciences, Zemabawk)

Blood Bank Management System (BBMS)

IMA Blood Bank, Dehradun approached C-DAC to upgrade/replace their existing BBMS application in April 2011. C-DAC developed a BBMS for them, which is designed to store, process, retrieve and analyze information concerned with the administrative, inventory management, and clinical aspects of providing services within a blood bank. It not only streamlines the working in a Blood Bank, but also boosts the efficiency of the entire operation centered on the management of a Blood Bank.

Domain Specific Language and Programming Platform for Synthetic Biology

The objective of this DeitY funded project is to design and develop a prototype of a Domain Specific Language and Programming Platform for creating new biological parts, devices and systems and re-design existing natural biological systems, which enables to create, analyze and simulate novel synthetic genome constructs. A domain specific language with configurable rule library and algorithms will significantly help biologists and scientists to quickly build, simulate and validate complex biological systems.

Education and Training

C-DAC's Education and Training activities aim to build and enhance skills in critical areas of Information Technology and electronic product development. Apart from offering various diploma programs and some formal degree programs in collaboration with universities, C-DAC also imparts IT training programmes to Government, Industry, Strategic sector and International participants. The activities carried out by C-DAC in this area during the year are described below.

Formation of Academic Council and Academic Management Committee

To further strengthen education and training activities of C-DAC, Director General constituted two committees, namely Academic Council (AC) and Academic Management Committee (AMC) which have members from all C-DAC centers across India. The terms of reference of the apex AC were to supervise, make strategic recommendations, frame policies, monitor quality, decide collaborations, etc. for C-DAC's various education and training programs. The terms of reference of the AMC were to look into all the operational issues and to implement AC's recommendations. As the first step, AC and AMC integrated various similar kinds of courses run by different center. Now C-DAC runs same courses across all centers and conducts them in synchronized manner.

Post Graduate Diploma Programs

Advanced Computing Training School (ACTS) of C-DAC through its nationwide Training Centers and Authorised Training Centers (ATCs) successfully conducted two batches (August 2012 and February 2013) of Post Graduate Diploma programmes of six months duration during the year. The following PG Diploma programs were conducted:

- PG Diploma in Advanced Computing (PG-DAC)
- PG Diploma in Wireless and Mobile Computing (PG-WiMC)
- PG Diploma in VLSI Design (PG-DVLSI)
- PG Diploma in IT Infrastructure and Systems and Security (PG-DITISS)
- PG Diploma in Integrated Embedded System and VLSI Design (PG-DIVESD)
- PG Diploma in Computational Linguistics and NLP (PG-DCLN)
- PG Diploma in Geoinformatics (PG-DGi)
- PG Diploma in Healthcare Informatics (PG-DHI)
- PG Diploma in Embedded System Design (PG-DESD)
- PG Diploma in System Software Development (PG-DSSD)
- Post Graduate Diploma in Automation SCADA Systems

Around 5000 students were trained in the two batches. All these students have been trained on the latest technologies so that they can be readily deployed on projects and solutions in the IT companies. Many of them are now placed in various IT companies. Some of them have also been recruited by C-DAC for its R&D projects.

Education Technology and e-Learning Initiatives

C-DAC has taken major initiatives in developing various applications and technologies in e-Learning and education technology domains. Some of them are listed below:

- **eMentor** is the unifying term to describe the fields of online learning, web-based training, and technology delivered instruction. It is web-enabled learning that encompasses training, education, just-in-time information and communication. It involves interactivity, which may include online interaction between the learner and their teacher

or peers. Its applications and processes include web-based learning, computer-based learning, virtual classrooms and digital collaborations.

- **My-Sikshak** extends the learning environment with personalized e-Learning services assisted by instructor. It mainly focuses on needs and aspirations of individual learners. This model recognizes that every student is an individual, with a distinct learning style, learning pace, learning path, and learning aspiration.

- **Collaborative Class Room (CCR)** is as online educational platform to support formal learning. Provision for creation of online educational federations is also available. CCR uses computational and storage grid for educational purpose. CCR facilitates any time, any place learning through real time audio/video conference and accesses computational and storage resources of GARUDA GRID, a national grid computing initiative.

- **Parikshak** is an Automated Program Grading and Analysis tool. It allows teachers to conduct programming exams in online mode, with auto-evaluation of student programming assignments, analysis after programming test, etc.

- **e-Pariksha** is a web based application for automation of the examination process. Its exam interface is designed in such a way that it can be used for school students to post graduate students. It provides a great control on exams from preparing question paper to scheduling exam and from monitoring exam to generate results. It zeros the manual evaluation process and reduces the workload of examiners. ePariksha has a strong administration, which provides complete system status at a glance. It has very easy processes for course management and examiners management. It's unique Switch Course functionality offers administration to regulate all course's exam. It's results and reports generation functionality provides system details in all standard and required formats.

- **e-Learning** Framework for Children with Cognitive Disability is a framework for children with mild mental retardation and austism in the age group of below 16 years. The developed framework falls in line with SarvaShikshaAbhiyan (SSA) programme.

- **eLearning** Platform for Medical Simulation [MEDSIM] is a project funded by DeitY. It aims at bringing the advantages of eLearning and Dynamic Immersion Simulation Technology to medical students in prescribing new drugs, ordering diagnostic tests, and developing new treatment strategies.

- **EduBOSS 3.0** is the educational variant of BOSS. EduBOSS, adapted from BOSS GNU/Linux, has educational applications that are useful for school students (primary and higher levels). EduBOSS 3.0 features educational resources, games, paint & graphic tools, typing tutor, and a host of tools and packages for basic learning, and also for teaching subjects like Maths, Science, Social studies, etc. for higher classes. The major updates in EduBOSS 3.0 GNU/Linux include latest Kernel, a major shift in GNOME desktop environment with gnome shell integration, LibreOffice 3.5 with Indian language support, Iceweasel web browser updated from 3.5 to 18.0.2, a Live installer that lets the user have EduBOSS up in his/her system without installing it on the hard disk. EduBOSS 3.0 is ready for release.

- **Mentor** is a m-learning solution to help students to access video lectures, reference material, assessment, etc., anywhere and anytime, using their mobile phones. It also helps instructors to do various management activities like course creation, map videos to different topics in a course, assign courses to students, report generation to assess student performance, configuration settings, etc.

- **eLearning Quality Research Lab:** C-DAC has established this lab for assessment of Learning Management System and online course content on a common platform with quality model comprising Accessibility, Usability,

Security, Performance attributes for LMS and Accessibility, Video Quality, Readability, Portability & Reusability, Course Effectiveness Index attributes for course content.

- **Context Aware Mobile:** C-DAC has designed and developed this software to give different players of e-learning ecosystem like teachers, students, developers, 3D content generators, etc. an environment to create immersive and interactive augmented reality based applications for different e-learning use-cases, like classroom/collaborative teaching, self-learning, learning by playing.

- **Online Labs (OLabs) for School Lab Experiments:** A total of 42 experiments have been completed and are available through the OLabs website http://www.olabs.co.in. OLabs has been deployed or being deployed in 30+ schools in Maharashtra, Kerala, and Karnataka.

- **Trainers Training and Student Talent Transformation:** Being carried out in collaboration with CBSE and a Portal is available for free online access at http://nrcfoss.cdacmumbai.in/newcbse. The portal contains study material, Formative Assessments, Class Activities, Animations on Hard spot topics for subjects such as Maths, Science, Social Science for CBSE Class IX and X. Two workshops for teachers (July 2012 and April 2013) were conducted to vet the authenticity of content and seek feedback on the usability of the portal.

- **Framework for Adaptive Instruction:** An Open Source Framework for Adaptive Instruction to deliver instruction in personalized manner has been designed and developed. Overall framework is internationalised and Hindi language support is provided.

- **Computer Enabled Continuous and Comprehensive Evaluation (CCE):** Using Adaptive Learning technologies, C-DAC in collaboration with Amrita Vishwa Vidyapeetham, Kerala, has developed an ICT enabled CCE framework. The framework is based on the CBSE Teacher's Manual and other appropriate material available on the CCE portal of CBSE Board's website for Class 9th & 10th.

- **Computer Aided Learning (CAL) Program under SarvaShiksha AbhiyanRajya Mission, Tripura:** Till now 360 school teachers across different districts of Tripura have participated in this training program and about 180 CAL Content Material has been developed by the trained teachers during the workshop session. This effort will ultimately benefit the school students by providing better methodology of teaching with better study material.

- **IT Based Computer Aided Design Centre for Creative Design and Development by Artisans/Weavers of Sikkim, Mizoram, Manipur, Tripura, Assam and Arunachal Pradesh:** This programme aims at mass scale proliferation of handloom sector, using modern concept and technology support. It develops a Master Trainer from each district periodically and utilizes the creative design development skill of the Artisans by using digitizing tablet and user friendly software solutions.

Faculty Development Programs

Advanced faculty training programs in emerging trends of Hardware, Embedded Systems and Information Technology were conducted under the scheme for Manpower Development for Software Export Industry, an initiative of HRD Division, DeitY. 155 faculty members of various engineering colleges have been given hands-on exposure to industry relevant areas of Information Technology. Electronic content development for the training programs conducted and research orientation to faculty who attended the training programs are some of the key activities of this programme.

Capacity Building Initiatives

- C-DAC, Kolkata has developed educational content with interactive multimedia based Learning solutions as per

the Syllabus of “School of Secondary Education”, Government of West Bengal. The content focuses on dissemination of multi-ferrous benefits of IT to school students.

- Capacity building programmes were conducted for IT skill development in economically weaker women and SHG members of Tripura district (South, North and Dhalai) and PurbaMedinipur district of West Bengal.

- C-DAC has undertaken capacity building programme in the areas of Electronic Product Design and Production Technology (EPDPT) in collaboration with NIELIT Aurangabad and NIELIT Chennai. The target is to train a total of 11,515 persons at various levels under this programme. Joint research has been carried out with other institutions and industries to identify areas in which research professionals need to be developed. The identified areas include industrial services setup and incubation facilities, product design & development, testing and calibration, job-work / batch production, and corporate training.

- C-DAC Thiruvananthapuram, using its training centres at Trivandrum and Kochi as well as the 24 Authorized Computer Education & Training Centres (ACETC), spread across Kerala State, and also utilizing the facilities of IT@School (where there are no ACETC), provided the Basic IT Training to the Kerala State Police personnel under CCTNS. Around 14000 police personnel were imparted training under this programme sponsored by the National Crimes Records Bureau (NCRB).

- C-DAC has undertaken capacity building programme for the upliftment of 2000 Scheduled Tribes (ST) candidates of Union Territory of Lakshadweep. The programme will help them utilize the existing and emerging opportunities in IT and ITES.

National Skill Development Programme

Advanced Computing Training School (ACTS), Pune completed the pilot batch of the Post Graduate Diploma in Advanced Computing (PG-DAC) for 300 Schedule Caste (SC) students who are domicile of the state of Maharashtra. The students were selected through an entrance examination conducted for 874 students, and 384 students were provided the preparatory course for PG-DAC (PreDAC) of 9 weeks duration as a bridge course to PG-DAC. The project was funded by Dr. Babasaheb Research and Training Institute, Pune, a society under Social Justice Department of Government of Maharashtra. After successful completion of the pilot batch, 298 successful students are undergoing National Level campus placement programme.

New Initiatives

AAKASH Tablet

Aakash is a series of Android-based tablet computers produced by an initiative of Ministry of Human Resource Development, Government of India. It is a low-cost tablet computer with a 7-inch touch screen. The device was developed as part of the country's aim to link 25,000 colleges and 400 universities in an e-learning program. The cost of basic version for a student was only Rs.1500 which was around USD35. In July 2010, Honorable Minister of Human Resource Development, Sri Kapil Sibal unveiled a prototype of Aakash, which was later given out to 500 college students to collect feedback. The tablet was officially launched as Aakash in New Delhi on 5 October 2011. Ministry of Human Resource Development, Government of India announced an upgraded second-generation model called Aakash 2 in April 2012. In this series, the new version of Aakash has been named as Aakash IV.

The main objective was to empower college teachers in the country to provide quality education, to millions of Indian students. This objective was to be achieved by procuring 1 Lakh tablets, developing appropriate applications, content and methods for their effective educational use and by deploying these in colleges. C-DAC plays crucial role in this project towards testing and evaluation.

Electronic Personal Safety System

The objective of the Electronic Personal Safety System is to assist women, children and the elderly in cases of emergency. The system has two components – the device, to be used by the people; and the backend system, to integrate with the police and other agencies. The compatible safety device can be provided by vendors but will integrate with backend via an inter-operable standard driver interface. This application will ultimately be transformed to a watch form factor, so that the user can wear it. The ePSD (Electronic Personal Safety Device) will help the woman/child or any person in distress & they can feel safe. The application allows them to press panic button whenever they feel unsafe. It tracks the location using GPS and alerts the right people. To spread the awareness about this solution, C-DAC will do the PoC in NCR & later distribute the ePSD through NGO's/BPO's. C-DAC will also look for tie-up with telecom operators and NGOs to promote the service. On the successful completion of the PoC, the same model will be replicated.

India Microprocessor

DeitY has been promoting the field of Microelectronics over the past several years. One of the major activities in this field is promotion of Research and Development with the involvement of academia, R&D institutions and industry in various areas including VLSI, Micro-sensors, Micro-Electro-Mechanical-systems, application development like programmable digital aid, analog and mixed signal devices, reconfigurable systems, discrete devices and human resource capacity building through specific programmes like "Special Manpower Development Programme in VLSI and Related Software (SMDP)".

As a step towards developing this field, DeitY has constituted a Working Group on Microelectronics. The Working Group on Microelectronics has recommended taking a comprehensive study on the requirement of development of Indian Microprocessor based on the preliminary analysis of the views expressed by industry, academia and R&D organizations at the Working Group meetings and other foray. In accordance with this, DeitY has constituted a "Study Team on India Microprocessor Development" for carrying out a feasibility study and prepare a draft proposal for the Indian Microprocessor Development.

C-DAC is actively involved in this initiative. The team is studying various commercial and open source microprocessor architectures and requirements of various strategic and R&D microprocessor users of the country. As part of the proposal, State of Art Design Laboratories are being proposed to be established at various C-DAC Centres to facilitate R&D activities in Microelectronics/ VLSI with contemporary EDA tools, technical and commercial foundry tie-ups,

basic IP cores licenses for standard cells, memory and IO, PHYs, MEMS-CMOS integration, etc. compatible with current fabrication technologies, geometries and processes.

Government of India Search Engine

The aim of this search engine is to enable the citizens to easily and quickly find pertinent State information in the areas of Government Executive, Judiciary, Legislature and Institutions such as Banking, Education, Healthcare, Research, International Missions abroad, Tourism, Sports and other Government or Semi-Government organizations and Committees or Commissions. This search engine is being developed with the following features.

- Allow searching through the contents in different formats like HTML, PDF, MS Office (2003), etc.
- Extraction and identification of entities like People-Places-Organization.
- Search suggestions and search-as-you-type
- Cross Lingual search
- Allow more sophisticated search results format by grouping the results in various categories as per different sub-topics associated with the query.
- Ontology search

Currently, it is targeted for English and Hindi. Spellchecker, Synonym, Acronym, Lemmatizer and other NLP tools will also be added to make the tool powerful.

Resources, Facilitation Services and Initiatives

Collaborations/Cooperations

1. C-DAC signed an MOU with KACST, Saudi Arabia for Joint research & development in Open Source. Scope of the agreement includes training the members from KACST Saudi Arabia team on the Libre Office tools, identifying needs for Arabic community in the existing Libre Office, contribution to Libre Office foundation in fixing the reported bugs and feasibility plan for new localised distribution for Linux.

2. Ministry of External Affairs (MEA) and C-DAC signed an agreement for two years support to India–Ghana Kofi Annan Centre of Excellence in ICT (AITI-KACE) in Accra. AITI-KACE project is considered to be a flagship project for the Government of India and therefore it was decided by Government of India to support AITI KACE for two more years through C-DAC.

3. MEA & C-DAC signed an agreement for setting up of India – Kazakhstan Centre of Excellence in ICT (IKCoEICT) at Astana.

Agreement signing for two years support to AITI-KACE

MEA & C-DAC signed an agreement for setting up of India – Kazakhstan Centre of Excellence in ICT (IKCoEICT) at Astana

4. MEA and C-DAC signed the agreement for setting up of India-Lesotho Center For Advance Education on IT (ILCAEIT). ILCAEIT is fully operational now and C-DAC is supporting it till April 2014. ILCAEIT is currently training a batch of 200 students in various domains of IT.

5. MEA and C-DAC signed the agreement for setting up of India-Armenia Centre for Excellence in ICT (IACoEICT). Since the inception of IACoEICT, the trainings have been held in the domains of Linux, Mobile Computing, Web Technologies, Java and System & Network administration. IACoEICT has trained over 1300 students along with conducting numerous HPC workshops for scientists.

6. India – Syria Centre for IT (ISCIT) at Damascus has been established by C-DAC. Experts from C-DAC were deputed at ISCIT for centre coordination & course delivery in the areas of advance IT & Cyber Security for a period of 2 years. C-DAC is currently providing academic support remotely till December 2013.

7. MEA & C-DAC signed an agreement for establishment of India – Grenada Centre for IT at St. George's. IGCIT is fully operational now and would train about 250 students every academic year in the various domains of Information Technology.

8. MEA & C-DAC signed an agreement for establishment of India – Dominican Republic Centre for IT (IDRCIT) at Santiago. IDRCIT is fully operational now and has trained about 200 students in various domains of Information Technology.

9. C-DAC has signed an agreement with MEA for acting as 'Project Manager cum Consultant' for setting up of computer labs in 72 schools under Tavush Region in Armenia.

10. MEA & C-DAC signed an agreement for establishment of India – Belarus Digital Learning Centre in ICT (DLC-ICT) at Minsk. DLC-ICT is fully operational now and C-DAC is providing academic support till February 2014. Since its inception, trainings have been held in the domains of agile methodologies of IT viz. Project Management, Software Testing, Java and .Net, Jira in project and testing management; E-Learning in Education, Business Analysis, My SQL and PHP – developing dynamic web applications. More than 300 teachers from 20 Belarusian universities have been benefited by these trainings.

C-DAC signed an agreement with MEA for acting as 'Project Manager cum Consultant' for setting up of computer labs in 72 schools in Armenia

Agreement signed for establishment of India – Belarus Digital Learning Centre in ICT

11. National Academy of Sciences (NAS) of Belarus and C-DAC signed a MOU on cooperation in ICT sector at New Delhi during the visit of Hon'ble Prime Minister of Belarus to India. In order to start the cooperation in the field of ICT, a proposal for creation of GRID infrastructure using HPC and development of GIS application software for the proposed GRID was discussed between United Institute of Informatics Problems (UIIP) and C-DAC.

12. MEA & C-DAC signed an agreement on March 14, 2013 regarding the upgradation of Jawaharlal Nehru India – Uzbekistan Centre for IT (JNIUCIT) at Tashkent. JNIUCIT at Tashkent was originally set-up by C-DAC.

13. Centre of Excellence has been established for the promotion of High Performance Computing in Vietnam through establishing "India – Vietnam Center of Excellence" at Hanoi University of Science & Technology, Vietnam.

14. C-DAC is collaborating with Institute for Computer Aided Design of the Russian Academy of Sciences (ICAD RAS), Moscow, Russia in the area of Computational Fluid Dynamics (CFD) and Computational Structural Mechanics (CSM).

15. A collaborative project work has been carried out between the Bioinformatics group of C-DAC and Oregon Health & Science University (OHSU) to provide computational support to the experimental works. The work has been published in the Journal of Molecular Biology in the year 2012.

16. The Centre of Excellence for Digital Preservation, C-DAC Pune has signed the MoU with University of British Columbia, Vancouver, Canada as a project partner in International Research on Permanent Authentic Records in Electronic Systems (InterPARES) for Trust, a project funded by Canadian Research Council.

17. C-DAC is collaborating with Internet Cooperation for Assigned Names and Numbers (ICANN) in the area of Internationalized Domain Names and new generic Top Level Domains (gTLDs).

18. C-DAC is collaborating with National Center for Atmospheric Research, Colorado, Boulder, USA for the specific objective of "Numerical algorithm development of atmosphere model dynamical core development. Application novel computing paradigm for weather and climate modelling."

19. C-DAC, Knowledge Park, Bangalore signed the Memorandum of Understanding (MOU) with National Institute for the Mentally Handicapped (NIMH), Secunderabad, Andhra Pradesh on September 11, 2012 for collaborating as Domain Experts for the "Adaptable e-Learning Accessibility Model for the Disabled" project.

20. MoU has been signed between C-DAC, Hyderabad and CSI Chapter, Hyderabad on conduction of ISEA programs on August 22, 2012.

21. MoU has been signed between C-DAC, Hyderabad and JNTU Hyderabad on ITS activities on December 10, 2012.

22. An MoU was signed on November 27, 2012, at Mumbai between Tata Memorial Hospital (TMH) and C-DAC, Pune to facilitate collaboration addressing challenging research areas where C-DAC, Pune can assist TMH in providing IT-enabled research solutions resulting in faster & effective research.

Patents

Patents Awarded

1. “A Method to Generate Earthquake Early Warning Using Mems Based Seismic Sensors and System Thereof”. Inventor(s): G. Reghunathan Nair and K. R. Rajesh; Patent No: 251809
2. “A Circuit to Reduce Stray Inductance and a 3-Phase Converter Thereof”. Inventor(s): A. K. Unnikrishnan, Aby Joseph and A. S. Haneesh; Patent No: 251807

Patents Filed

1. “Real-Time Character Detection Method for Augmented Reality Applications”. Inventor(s): Utkarsh Mankad
2. “A Method for Creating and Interactive Augmented Reality (AR) Board”. Inventor(s): Chitrapu Venkata Ramdas
3. “Method of Using Light Pointing Device as a Virtual Writing Tool in Augmented Reality Environment”. Inventor(s): Parimal Naigaonkar
4. “A Two-factor Password-based Authentication Method for Web Users”. Inventor(s): Mohamad Misbahuddin
5. “A Secure and Usable Text-o-Graphic Password Method to Authenticate Web Users”. Inventor(s): Mohamad Misbahuddin
6. “System and Method for Segmentation of Slap Fingerprints”. Inventor(s): Zia Saquib, Santosh Kumar Soni, Sweta Suhasaria, Varunkrishnan T. K., Pratibha Mokal and Anamika Singh
7. “A Secure and Usable Text-O-Graphic Password Method to Authenticate Web Users”. Inventor(s): Mohammed Misbahuddin, P. Premachand, A. Govardhan and Zia Saquib
8. “A Novel Plant Proteinase Inhibitor against Insects Gut Proteases". Inventor(s): R. S. Joshi, M. Mishra, V. A. Tamhane, A. Ghosh, U. Sonavane, R. Joshi and A. P. Giri
9. “Method And System for Surface Vibration Measurement, Monitoring and Analysis, Using Ultrasonic Non Contact Measurement Technique, Employing Frequency Down Conversion”. Inventor(s): Mohanachandran R., Haneesh Sanker R. and Subodh P. S.
10. “Device and Method for Detecting Double Talk Condition and Cancelling the Returned Echo from Received Speech Signal in a 2-way Communication System”. Inventor(s): Simon Zachariah, Satheesh Prabhu, Soumya Murali and Annu Liza Jose
11. “A Modified Non-Linear Processor with Adaptively Programmable Transfer Characteristics for Echo Canceling in 2-way Communication Systems”. Inventor(s): Simon Zachariah, Satheesh Prabhu, Soumya Murali and Annu Liza Jose
12. “A Modified Method of Echo Canceling in 2-way Communication Systems by Companding of Signals in the Adaptive Filter Path”. Inventor(s): Simon Zachariah, Satheesh Prabhu, Soumya Murali and Annu Liza Jose
13. “A Device and Method for Improving The Target Resolution and Transmission Power Requirements for Acoustic/ Ultrasonic Sensor Based Mobility Aid to The Visually Challenged and Blind”. Inventor(s): Mohanachandran R., Murali R., Byju C., Aravind C. R., James Varghese and Harikrishnan C. S.
14. “Acoustic Torch for Visually Challenged”. Inventor(s): Mohanachandran R., Murali R., Byju C., James Varghese and Parvathy S. R.
15. “Selective Harmonic Detection”. Inventor(s): Subhash Joshi T. G., Aby Joseph and Unnikrishnan A. K.

Awards & Accolades

1. Received the National Award instituted by Ministry of Social Justice & Empowerment (MoSJ&E), Govt. of India for “Development of Best product and technology to empower physically impaired persons”. The Award was for the successful design and development of the low cost, high performance Digital Programmable Hearing Aid for mass proliferation. The award was presented by His Excellency the President of India Shri Pranab Mukherjee, at a function held on February 6, 2013 at Vigyan Bhavan, New Delhi.

National Award for Digital Programmable Hearing Aid

2. Won Manthan Awards for South Asia and Asia Pacific Region for the year 2012 in 3 different categories:
   - **e-Culture & Heritage:** For ‘The Interactive Museum Project’
   - **eInfrastructure:** For ‘National eGovernance Service Delivery Gateway (NSDG)’
   - **e-Health:** For ‘Megh Sushrut (Health Management Information System – Cloud Version)’

3. Awarded the prestigious SKOCH Digital Inclusion Award for 2012 for "BharatiyaAFIS" (Bharatiya Automated Fingerprint Identification System). The Silver award was under the Category of Innovation. The award was presented by Honorable Union Minister of Law & Justice, Shri Salman Khurshid on September 18, 2012 at the Skoch Digital Inclusion Awards 2012 ceremony held in New Delhi, in presence of DeitY Secretary, Mr. J Satyanarayana and Mr. Nandan Nilkani.

4. Bagged Young IT Professional Award (2012) organized by Computer Society of India (CSI) for Region-V at Computer Society of India, Bengaluru on 27th February, 2013 for the project “Secured Energy Monitoring, Accounting and Web Based Reporting” developed for Madhya Gujarat Vij Company Limited.

5. Awarded Best Government to Business (G2B) Initiative of the Year eMaharashtra 2012 for the ‘Short Term Open Access’(STOA) software developed by C-DAC. The STOA software was developed for the Western Regional Load Despatch Centre (WRLDC) Mumbai. The award was presented by Prof (Smt) Fauzia Tehseen Khan, Hon’ble Minister of State for General Administration, Information and Publicity, Cultural Affairs, Protocol, School Education, Women and Child Development, Public Health and Family Welfare, Minorities Development, Government of Maharashtra during the eGov award ceremony held at Mumbai on April 27, 2012.

6. Received State E-Governance Award for e-Ausadhi, Health Management Information System (HMIS) on February 12, 2013 in a State Ministerial Level Meeting held at Jaipur under the chairmanship of Hon’ble Chief Minister, Govt. of Rajasthan.

7. Won eIndia 2012 award for Best Use of Technology in Telehealth for the application MOTHER (Mobile based

maternal Health Awareness) in the eIndia 2012 conference held on November 15 & 16, 2012 at Hyderabad. The award was presented by Shri Ponnala Lakshmaiah, Minister for Information Technology and Communications, Andhra Pradesh.

8. Received Best Exhibition Stall Award for e-security stall at SecurIT International Conference, organized by Amrita University, Kollam on August 19, 2012.

9. Received Best Exhibitor Award for Design and Innovation at Bangalore Bio 2013, on February 5, 2013.

SKOCH Digital Inclusion Award for "BharatiyaAFIS"

eIndia Award for "MOTHER"

Events/Conferences/Workshops

1. Workshop on National Mission on Supercomputing at Pune on February 8, 2013.
2. Garuda-NKN Partners Meet at NIAS Auditorium, Bangalore on July 20 & 21, 2012.
3. Garuda Grid Workshop for Scientific and Engineering Applications, C-DAC, Pune, August 7-8, 2012.
4. Garuda Boot Camp at Dr. M.G.R Educational and Research Institute, Chennai, on September 6 & 7, 2012.
5. Garuda Boot Camp at Indian Institute of Technology (BHU) Varanasi, on March 6 & 7, 2013.
6. GARUDA Boot Camp, at Space Applications Centre (SAC), Ahmedabad, on April 20, 2012. The event was jointly organized by C-DAC and SAC Ahmedabad.
7. National Conference on Parallel Computing Technologies “PARCOMPTECH India 2013” was organized by C-DAC at NIAS, Bangalore during February 21-23, 2013.
8. ‘Accelerating Biology: The next wave’ symposium was conducted during Feb 20-22, 2013 at Yashada, Pune. The symposium was attended by more than130 participants and included talks by eminent scientists across the globe. An interactive poster session was also conducted.
9. One day workshop “Adaptable and Accessible e-Learning (A2EL) Framework for Learners with special needs” conducted on July 26, 2012 conducted at C-DAC Knowledge Park Bangalore.
10. Two days “Master Trainer Workshop on Adaptable and Accessible e-Learning (A2EL) Framework” was held on November 29-30, 2012 at C-DAC Hyderabad.
11. “Silver Jubilee Bioinformatics Conference” was held at Bioinformatics Centre, Pune during December 6-8, 2012.
12. BOSS GNU/Linux awareness workshop was conducted for Karnataka State government officials on March 15, 2013 at C-DAC Bangalore VVT office.
13. C-DAC Bangalore along with IEEE Bangalore section and IEEE Computer society Bangalore chapter had organized a one day seminar on Cyber Security in IT and SCADA Systems (CSIS 2013) at Knowledge Park, Bangalore on February 9, 2013.
14. One day national workshop on “Mobile & Ubiquitous Learning” was conducted by C-DAC Hyderabad in association with School of IT, JNTUH and technically co-sponsored by IEEE Hyderabad Section and Athabasca University, Canada on April 3, 2012 in Hyderabad.
15. C-DAC Hyderabad, in collaboration with JNTU Hyderabad, organized a workshop on “w-Suraksha – Securing Web” on May 11, 2012.
16. Two days master trainers workshop for special educators on “Adaptable e-Learning Framework” was conducted jointly by C-DAC Hyderabad and C-DAC Bangalore centres during November 29-30, 2012, at C-DAC Hyderabad.
17. One day national workshop on “Mobile Learning” was conducted jointly by C-DAC Hyderabad and Thiagarajar College of Engineering (TCE) Madurai on February 21, 2013.
18. One day workshop on Mobile Security on February 2, 2013, in collaboration with IEEE Hyderabad Chapter and SIT (JNTU).
19. Conducted 2 Day Conference on Information Security during March 8 & 9, 2013 at Jawaharlal Nehru Auditorium, Hyderabad where 1100+ Engineering Students participated.
20. Brainstorming Workshop on India Development Gateway (InDG), New Delhi, December 17, 2012.
21. SSDG awareness Training was conducted for Tata Consultancy Services (TCS) on March 13, 2012 & Hewlett-Packard (HP) on June 4, 2012 at C-DAC Juhu Mumbai.
22. FRR Field Testing and Biometric Device Certification for Aadhaar Authentication: Second Workshop for Participating Suppliers, July 6, 2012, STQC, New Delhi.
23. FRR Field Testing and Biometric Device Certification for Aadhaar Authentication: First Workshop for Participating Suppliers, June 18, 2012, STQC, New Delhi.

24. A workshop was organized on “Intellectual Property Rights (IPR)” at C-DAC JUHU Office (Mumbai) on April 26, 2012.
25. As a part of the silver jubilee year celebrations of C-DAC, 1st C-DAC Technology conclave was held at Hyderabad during October 4-6, 2012.
26. As part of the 3-day C-DAC Technology Conclave, held at Hyderabad during October 4-6, 2012, a camp was organized with the support of the Govt. ENT hospital, Schools and Charitable institutions in Hyderabad. Twenty two children, with severe to profound hearing loss, were fitted with Body Worn Hearing aids developed by C-DAC, Thiruvananthapuram.
27. Computer Training Programme for Visually Challenged, October 4-6, 2012 during C-DAC Technology Conclave at Hyderabad.
28. 2nd C-DAC Technology conclave was held at New Delhi during February 11-12, 2013.

C-DAC Technology conclave at New Delhi

29. 5th National Workshop on Telemedicine Today & Tomorrow – LATEST TRENDS at C-DAC Mohali on July 6, 2012.
30. Center for Development of Advanced Computing (C-DAC) Pune, and Centre for Modelling Simulation and Design (CMSD), University of Hyderabad (UoH) jointly organized five days technology workshop on Heterogeneous Computing CPU/GPU HPC Cluster - Algorithms & Performance of Application Kernels (Initiatives on Power Efficiency - Green Computing) (HeGaPa - 2012) at Hyderabad during July 16 - 20, 2012.
31. C-DAC, Thiruvananthapuram celebrated the National Science Day on February 28, 2013 which was the culmination of a series of events organized from 8th of February 2013, as part of the Science Day celebrations. The focal theme for this year’s National Science Day was “Genetically Modified Crops and Food Security- Issues and Prospects”.
32. C-DAC, Thiruvananthapuram conducted a one-day workshop on “Indigenous Advanced Automation System for Drinking Water Treatment Plants” on February 22, 2013 at Thiruvananthapuram, to create awareness amongst the stakeholders in the country, about the Automation System products indigenously developed by C-DAC, Thiruvananthapuram under the ASTeC (Automation Systems Technology Centre) Programme.
33. C-DAC, Thiruvananthapuram, along with State institute of Languages and Thunjathezhuthachan Malayalam University, organized a workshop on “Font Design” during March 14-15, 2013 at C-DAC, Thiruvananthapuram.
34. A workshop on “FPGA Based System Design: a SoC approach” was organized at C-DAC, Bangalore from June 25 – July 5, 2012.

35. One day tutorial on Cryptographic algorithms implementation Considerations was held on May 12, 2012 at C-DAC, Bangalore.
36. HeGaPa-2012 organised by C-DAC, Pune, Hands-on training on OpenMP, MPI and GPU programming, July 16-20, 2012.
37. Training on “ANVAYA: A workflows environment for automated genome analysis“ was conducted on 22 May 2012 at JNU, New Delhi.
38. 2 weeks’ training programmes offered during the year at C-DAC, Hyderabad:
    - System Design using FPGA (May 14-25, 2012)
    - Network Security and Malware Analysis (May 14-25, 2012)
    - Enterprise Solutions for Web Applications (May 28 - June 8, 2012)
    - Network Security and Security Engineering (June 11-22, 2012)
    - Hardware and Firmware Design for ARM based Embedded Systems (June 18-29, 2012)
39. Computer Training Programme for Visually Challenged from July 23, 2012 to August 4, 2012 at C-DAC, Kharghar, Navi Mumbai.
40. Computer Training Programme for Visually Challenged, January 18-19, 2013 at Little Flower Convent School, Chennai in collaboration with C-DAC, Chennai.

Research Papers Published/Presented

1. Subramanian Neelakantan and Shrisha Rao, “A Threat-Aware Hybrid Intrusion – Detection Architecture for Dynamic Network Environments”, CSI Journal of Computing, Vol. 1 Issue 3 Pages 17, Publisher: CSI, November 2012.
2. Mohamad Misbahuddin, “A Usable and Secure Two-factor Authentication Scheme”, International Journal of Information Security (Taylor and Francis), Vol. 21, Issue 4, June 2012.
3. P R Lakshmi Eswari and N Sarat Chandra Babu, “Combating Malware Threat using Hybrid Security Model”, International Journal of Intelligent Computing Research (IJICR), Volume 3, Issues 1/2, March/Jun 2012.
4. Himanshu Pareek, Sandeep Romana and P R L Eswari, “Application whitelisting: Approaches and Challenges”, International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), Vol.2, No.5, October 2012.
5. Himanshu Pareek and P R L Eswari, “Entropy and n-gram Analysis of Malicious PDF Documents”, International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 2, February 2013.
6. M. G. Seelan and Ch. A. S. Murty, “An Integrated Solution for both monitoring and controlling for automation using wireless sensor networks: A case study”, International Journal of Network Security & Its Applications (IJNSA), Vol.5, No.1, January 2013.
7. Limaye B, Banerjee R, Datta A, Inamdar H, Vats P, Dahale S, Bhandari A, Ramakrishnan EP, Tupakula R, Malviya S, Bayaskar A, Gadhari R, Jain S, Gavane V,Mahajan R, Sunitha K and Joshi R., “Anvaya: a workflows environment for automatedgenome analysis”, Journal of Bioinformatics and Computations Biology, vol. 10, no. 04, 2012.
8. Kanika Kaur and Arti Noor, “Minimization of Leakage Current in VLSI design”, International Journal of Scientific and Engineering Research (IJSER), Volume 3, Issue 4,pp. 201-205, April-2012, ISSN 2229-5518.
9. Sajeevan G., “Dynamic Composite Key to Link Spatial Database to External Database”, Journal of Geomatics 6(1), pp .5-6, April 2012.
10. Joyanta Basu, Milton Samirakshma Bepari, Rajib Roy and Soma Khan, “Telephony Speech Recognition System: Challenges”, Proceedings of CTNGC 2012 at ITS Ghaziabad, UP, India, October 20, 2012, pp. 30-36.
11. Pradeep K. Sinha, Gaur Sunder, Prashant Bendale, Manisha Mantri and Atreya Dande, "Electronic Health Record: Standards, Coding Systems, Frameworks and Infrastructures," IEEE PRESS, December 17, 2012.
12. N.Baneesh, "Language modeling for automatic speech recognition: Malayalam", International Journal of Dravidian Linguistics (IJDL), Vol.41, No.2, P.103-119, June 2012.
13. Nirmala Salam and Rekha Nair, “An Optimized Real Time Image Codec for Image Data Transmission and Storage”, International Journal of Computer Applications (IJCA), Vol. 45, No. 15, May 2012.
14. Rekha Nair, Nirmala Salam, Ashutosh Singh, and Ganesh Joshi, “Efficient method for Additive and Convolutive Noise Reduction International Journal of Electronics and Computer Science Engineering”, IJECSE, Vol. 1, No. 4, August 2012.
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138. Sachin P. Nanavati, V. Sundararajan, Shailaja Mahamuni, S. V. Ghaisas and Vijay Kumar, “Nonstoichiometric Mn doped ZnO magic nanoclusters and their composite structures from ab initio calculations”, 2012, Physical Review B, Volume 86, pp. 205320-205327.

139. Sachin P. Nanavati, V. Sundararajan, Shailaja Mahamuni, S. V. Ghaisas and Vijay Kumar, “Atomic clusters of magic (ZnSe)n (n=13, 33 and 34) clusters from first principles calculations”, First National Conference on Mapping the Materials Genome, Shiv Nadar University, Gautum Budh Nagar, March 8-10, 2013.
140. Vijay Kumar, Sachin P. Nanavati, V. Sundararajan, Shailaja Mahamuni, and S. V. Ghaisas, “Mn doped II-VI quantum dots from ab initio calculations”, 2012, poster presentation at CECAM workshop on Theoretical Challenges in Electronic Structure of Clusters and Nanoparticles at Lausanne, Switzerland, July 4-6, 2012.
141. Sachin P. Nanavati, V. Sundararajan, Shailaja Mahamuni, S. V. Ghaisas and Vijay Kumar, “Magnetic, magic, non-stoichiometric clusters of Mn doped II-VI quantum dots from ab initio calculations”, 2012, poster presentation at the 16th International Symposium on Small Particles and Inorganic Clusters (ISSPIC XVI), Leuven, Belgium, July 8-13, 2012.
142. Akshay Yadav, V. K. Jayaraman, Mohan Kale and Urmila Kulkarni-Kale, “Phylogenetic Clustering of Protein Sequences Using Recurrence Quantification Analysis”, 2013, Adv. Sci. Lett. 19, 1336-1339.
143. S RamyaKumari, Kiran Kadam, Ritesh Badwaik and Valadi K Jayaraman, “LIPOPREDICT: Bacterial lipoprotein prediction server”, 2012, Bioinformation, 8(8).
144. Kiran Kadam, Prashant Prabhakar and V. K. Jayaraman, “SVM prediction of ligand binding sites in bacterial lipoproteins employing shape and physio-chemical descriptors”, 2012, Protein Pept. Lett, 19, 1155-62.
145. S RamyaKumari, RiteshBadwaik, Vijayaraghavan Sundararajan and V. K. Jayaraman “DEFENSINPRED: Defensin and defensin types prediction server”, Protein Pept. Lett, 2012, 19, 1318-23.
146. Shaini Joseph, Shreyaskarnik, PravinNilawe, V. K. Jayaraman and Susan Idicula Thomas, “ClassAMP: a prediction tool for classification of antimicrobial peptides”, IEEE/ACM Transactions on Computational Biology and Bioinformatics. 9, 2012, 1535-1538.
147. M. Kumar, S. Jayaraman, S. Bhat, S. Ghosh and V.K. Jayaraman, “Variable Selection and Fault Detection using a Hybrid Intelligent Water Drop Algorithm”, 2012, Presented at the Second International conference on Soft Computing for Problem Solving (SocPros, 2012), Jaipur.
148. Atulji Srivastava, Shameek Ghosh, N. Anantharaman and V. K. Jayaraman, “Hybrid Biogeography based Simultaneous Feature Selection and MHC Class I Peptide Binding Prediction using Support Vector Machines and Random Forests”, 2012, Presented at the 11th International Conference in Bioinformatics (InCoB2012) held at Bangkok, Thailand.
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150. Pallavi Gavali, Mahesh Shah and Aarti Bhalerao, “Incremental Dynamic Analysis and Simulations of Reinforced Concrete Building frame Structure using OpenSees on High Performance Computing”, 8th Biennial Conference on Structural Engineering Convention SEC 2012 at S. V. National Institute of Technology during December 19-21, 2012. P 67-73.
151. Pallavi Gavali and Aarti Bhalerao, “Non linear Dynamic Analysis of RCC Frames”, National Conference on emerging trends in Engineering, Technology and Architecture 2013 (NCETETA) at D. Y. Patil College of Engineering And Technology Kolhapur on January 29, 2013.
152. Pallavi Gavali and Aarti Bhalerao “Incremental Dynamic Analysis” presented at SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad, Nasik at 2nd International Conference on recent trends in Engineering and Technology, February 22-24, 2013.
153. Yogesh Singh, P. Ferrazzoli and Rahmoune R, “Flood Monitoring using Passive Remote Sensing (AMSR-E) in Part of Brahmaputra Basin, India”, IEEE International Geoscience and Remote Sensing Symposium Remote Sensing for a Dynamic Earth (IGARSS), July 22-27, 2012, Munich, Germany.
154. R. Rahmoune, Yogesh Singh, P. Ferrazzoli, Y. Kerr, P. Richaume, A.Albitar, R. Magagi, C. Moisy, “Improved SMOS Soil Moisture Algorithm & Validation over North America Forests”, SMOS Land Application Workshop, Feburary 25-27, 2013, Frascati (Rome), Italy.

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156. Manish Kale, “Intermediate Biophysical Parameters for Carbon Study”, India-UK Scientific Seminar on ‘Quantifying Terrestrial Carbon Uptake from Earth Observation Data: Challenges and Opportunities’, Indian Institute of Technology, Kharagpur, India, December 19-22, 2012.

157. Sajeevan G., Jitendra Mhatre, Pinak Ranade, Upasana Dutta and Sunil Londhe, “GRIMMS Web -Connecting India”, Geospatial Today 11(9) 42-43, November 2012. pp. 42-43.

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161. R. Gupta and S. Unde 'Towards evolution of localisation standards in Indian scenario', Translation, Technology and Globalization in Multilingual Context 3rd International Conference, New Delhi, June 23-26, 2012.

162. R. Prakash and P Ravikumar, “Intelligent Wireless Road Traffic Signal Controller”, National Conference on Urban Mobility – Challenges, Solutions and Prospects, IIT Madras, July 13-14, 2012.

163. E. B. Benoygopal, “Intelligent Red light Violation and Detection system (iRIDS)”, National Conference on Urban Mobility – Challenges, Solutions and Prospects, IIT Madras, July 13-14, 2012.

164. K. Kiruba and G Satheesh, “Parking Made EASY with ePark - A Sparkling Technology”, National Conference on Urban Mobility – Challenges, Solutions and Prospects, IIT Madras, July 13-14, 2012.

165. A. Saravana Kumar, “Success story of NPP funded projects (STATCOM for IT Park & DVR)”, at “R&D Conclave 2012 - Emerging Opportunities and challenges of R&D in Indian Power Sector”, organized by Ministry of Power, Government of India, October 19-20, 2012.

166. Z.V. Lakaparampil, “Power Electronics for Micro Grids”, Indo-US interactive meet on Hybrid Electric Power Systems (HELPS), organized by DRDO, at NMRL, Mumbai, October 18-19, 2012.

167. Asha S A, Reshmi V G, Sudalaimani C, Devanand P, Elizabeth Thomas T, and Sudhamony S, “Automated Seizure Detection from Multichannel EEG Signals using Multiple SVM Models”, IEEE International Symposium on IT in Medicine and Education (ITME2012), August 3-5, 2012.

168. Thara S Pillai, Abey S A, Elizabeth Thomas T, and Sudhamony S, “A Medical Document Semantic Analyzer for extracting EMR data from electronic patient narratives”, IEEE International Symposium on IT in Medicine and Education (ITME2012), August 3-5, 2012.

169. Pournami S Chandran, Byju N B, Deepak R U, Rajesh Kumar R, Sudhamony S, Patrik Malm, Ewert Bengtsson, “Cluster Detection in Cytology Images using the Cellgraph Method”, IEEE International Symposium on IT in Medicine and Education (ITME2012), August 3-5, 2012.

170. Byju N B, Rajesh Kumar R, “Automated Calibration of Microscope based on Image Processing Methods”, The 4th International Conference on Signal and Image Processing (ICSIP), Dr. N.G.P Institute of Technology, Kalapatti, Coimbatore, December 13-15, 2012.

171. Devanand P, Elizabeth Thomas, Pradeep Balachandran, Shaji A, and Sudhamony S, ”Voice Enabled Electronic Medical Record Management System”, The 33rd Annual Conference of Linguistic Society of Nepal, held in Kathmandu, Nepal, November 26-27, 2012.

172. Parvathy K and Rajesh Kumar R, “De-mosaic-ing: Study and Application in Cytology Image Analysis”, IEEE INDICON 2012, conference held in Kochi, Kerala, December 7-9, 2012.

173. Asha S A, Sudalaimani C, Devanand P, Elizabeth Thomas T and Sudhamony S, “Automated Seizure Detection from Multichannel EEG Signals using Support vector Machine and Artificial neural Networks”, The IEEE International Multi Conference on Automation, Computing, Control, Communication and Compressed Sensing (iMac4s-2013), held at ST. Joseph College of Engineering and Technology, Palai, Kottayam, Kerala, March 22-23, 2013.

174. Devanand P, Elizabeth Thomas T, Pradeep Balachandran, Shaji A and Sudhamony S, "Ergonomic Technologies for Healthcare Workflow", E-Health Summit 2012, held at Hyderabad International Convention Centre, Hyderabad, November 16, 2012.

175. Marine Astruc, Patrik Malm, Rajesh Kumar and Ewert Bengtsson, “Cluster Detection and Field-of-View Quality Rating - Applied to Automated Pap-smear Analysis”, 2nd International Conference on Pattern Recognition Applications and Methods, Barcelona, Spain, February 15-18, 2013.

176. Sajini T, Arathi R and Bhadran V K, “The Intricacies of Speech”, National Seminar on Speech Synthesis and its Applications, organized by the Department of Linguistics, University of Kerala in collaboration with Linguistic Data Consortium for Indian Languages (LDC-IL), Central Institute of Indian Languages (CIIL), Mysore and the Kerala State IT Mission, Government of Kerala, Thiruvananthapuram, July 9-11, 2012.

177. Sajini T, Aswathy P V and Bhadran V K, “Bilingual TTS (English-Malayalam) using festival frame work”, National Seminar on Speech Synthesis and its Applications, organized by the Department of Linguistics, University of Kerala in collaboration with Linguistic Data Consortium for Indian Languages (LDC-IL), Central Institute of Indian Languages (CIIL), Mysore and the Kerala State IT Mission, Government of Kerala, Thiruvananthapuram, July 9-11, 2012.

178. Arathi R, Jayan V, Sunil R, Sulochana K G and Ravindra Kumar R, ”Divergence Patterns in Machine Translation between Malayalam and English”, The International conference on Advances on Computing, Communications and Informatics (ICACCI 2012), at RMK Engineering College, Chennai, August 3-5, 2012.

179. P.Shobana Devi, Jose Stephen, Sulochana K G and Ravindra Kumar R, ”Implementation of Dictation system for Malayalam Office Document”, The International conference on Advances in Computing, Communications and Informatics (ICACCI 2012), at RMK Engineering College Chennai, August 3-5, 2012.

180. Vidya V, Indhu T.R., Bhadran V.K., Ravindra Kumar R, ”Malayalam Offline Handwritten Recognition Using Probabilistic Simplified Fuzzy ARTMAP”, The International Symposium on Intelligent Informatics (ISI’12), at RMK Engineering College, Chennai, August 4-5, 2012.

181. Vinod P M, Jayan V and Bhadran V K, “Implementation of Malayalam Morphological Analyzer Based on Hybrid Approach”, The 24th International Conference on Computational linguistics and speech processing (ROCLING 2012), organized by the Yuan Ze University, Chung Li, Taiwan, September 21-22, 2012.

182. Dinesh T, Jayan V and Bhadran V K, “Word Category Disambiguation for Malayalam: A Language Model Approach”, The Second International Conference on Computational Science, Engineering and Information Technology (CCSEIT-2012), organized by the Avinashilingam University, Coimbatore, India, October 26-28, 2012.

183. Vidya V, Indhu T.R and Bhadran V K, “Classification of Handwritten Document Image into Text and Non-Text Regions” , The 4th International Conference on Signal and Image Processing (ICSIP 2012), organized by Dr. N.G.P Institute of Technology, Kalapatti, Coimbatore, December 13-15, 2012.

184. Vinod P M, Jayan V and Bhadran V K, “Implementation of Malayalam Morphological Analyzer Based on Hybrid Approach”, The 24th International Conference on Computational linguistics and speech processing (ROCLING 2012), organized by the Yuan Ze University, Chung Li, Taiwan, September 21-22, 2012.

185. Jayan V and Bhadran V K, “Paribhashika: English to Malayalam MT system”, The 22nd Swadeshi Science Congress, held at CPCRI Kasaragod, Kerala, November 6-8, 2012.

186. Unnikrishnan A.K, Aby Joseph, Saravana Kumar A and Subhash Joshi T.G, “Four-leg Active Filter based Solutions to IT Park’s Power Quality Issues”, IEEE International Conference on Power Electronics, Drives and Energy System (PEDES) 2012, organized by CPRI, Bengaluru, December 16-19, 2012.

187. Sunil R, Jayan V and Bhadran V K, “Disambiguation of pre/post positions in English – Malayalam Text Trans-

lation", Workshop on Machine Translation and Parsing in Indian Languages in COLING 2012, held at IIT Mumbai, December 15-16, 2012.

188. Sunil R, Jayan V and Bhadran V K, "Preprocessors in NLP Applications: In the Context of English to Malayalam Machine Translation", The IEEE annual conference (INDICON 2012)", held at Rajagiri College of Engineering, Cochin, December 6-8, 2012.
189. Indhu T R and Bhadran V K, "Malayalam Online Handwriting Recognition System: A Simplified Fuzzy ARTMAP Approach", The IEEE annual conference (INDICON 2012), held at Rajagiri College of Engineering, Cochin, December 6-8, 2012.
190. Shobana Devi P, Anu V Anand, Jose Stephen and Bhadran V K, "Malayalam Speech Recognition System and Its Application for visually impaired people", The IEEE annual conference (INDICON 2012), held at Rajagiri College of Engineering, Cochin, December 6-8, 2012.
191. Vidya V, Indhu T R and Bhadran V K, "Classification of Handwritten Document Image into Text and Non-Text Regions", 4th International conference on Signal and Image Processing (ICSIP2012), held at Coimbatore, Tamilnadu, December 14-15, 2012.
192. Sajini T, Binil Kumar S L and Bhadran V K, "Unit selection based Malayalam text to speech system integrated with disability aids", The 3rd national conference on Indian language computing (NCILC-2013), held at Cochin, January 19-20, 2013.
193. Anjali .M, Jose Stephen, and Bhadran V K, "Interactive News Reading System", 25th Kerala Science Congress held at Techno park Trivandrum, January 29-February 1, 2013.
194. Joby Thomas, "Remotely Operated Submersible (ROS)", National Technology Congress 2013 (NATCON 2013), conducted by Centre for Engineering Research & Development (CERD) and Rajiv Gandhi Institute Of Technology (RIT), Kottayam, March 2, 2013.
195. C.Balan, Divya S. Vidyadharan, P. Shabana, and K. L. Thomas, "Carving of Bitmap Files from Digital Evidences by Contiguous File Filtering", International Conference on Security in Computer Networks and Distributed Systems 2012, held at Indian Institute of Information Technology and Management-Kerala (IIITM-K), Technopark Campus, October 11-12, 2012.
196. Dija S, Deepti T R, C.Balan and K. L. Thomas "Towards Retrieving Live Forensic Artifacts in Offline Forensics", International Conference on Security in Computer Networks and Distributed Systems (SNDS'12), conducted at Indian Institute of Information Technology and Management-Kerala (IIITM-K), Technopark Thiruvananthapuram, October 11-12, 2012.
197. Meera V, Meera Mary Isaac and Balan C, "Forensic Acquisition and Analysis of VMware Virtual Machine Artifacts", International Multi Conference on Automation, Computing, Control, Communication and Compressed Sensing-2013, St. Joseph's College of Engineering & Technology, Palai, Kerala, March 23, 2013.
198. Mr. Ravikumar Ragam, Mr. Baneesh N and Dr. Shanmugam R, "Bodo Spell Checker: A Finite State Automata Approach" during 18 Himalayan Languages Symposium, the international conference held during September 10-12, 2012 at Banaras Hindu University, Varanasi, India.
199. Mr. Atiur Rahman Khan, "Digitizing Language with NLP tools and Technologies: An overview of Nepali" during 18 Himalayan Languages Symposium, the international conference held during September 10-12, 2012 at Banaras Hindu University, Varanasi, India.

Invited Talks

1. Abey Jacob, Indian e-infrastructure, CHAIN reds Workshop, EGI, Academia Sinica, Taipei, Taiwan, March 18, 2013.
2. Abey Jacob, The innovation and collaboration on Indian national grid computing initiative – Garuda, ISGC 2013, Academia Sinica Grid Computing Centre (ASGC), Academia Sinica, Taipei, Taiwan, March 19, 2013.
3. Abey Jacob, A dynamic monitoring framework and methodologies adapted for Grid GARUDA, ISGC 2013, Academia Sinica Grid Computing Centre (ASGC), Academia Sinica, Taipei, Taiwan, March 19, 2013.
4. Divya MG, Challenges & Opportunities in GARUDA - The national grid computing initiative, NMEICT (National Mission On Education through Information and Communication Technologies), NIT, Tiruchirappalli, February 12, 2013.
5. R. Sridharan and J. Santhosh, Distributed computing via gird and cloud, ISCON Conference GLA University, Mathura, March 8, 2013.
6. Dr. Prahlada Rao B.B., Cloud Computing Introduction, RATE2, TJOHN Engineering College, Bangalore, March 28, 2013.
7. Dr. Prahlada Rao B.B., HPC Application in BigData, TEQIP, RVC Engg College, Bangalore, March 21, 2013.
8. Payal Saluja, Cloud Computing, TEQIP-2 sponsored workshop on Heterogeneous computing, M S Ramaiah Institute of Technology (MSRIT), Bangalore, March 15, 2013.
9. Vineeth Simon Arackal, Cloud Computing and C-DAC Scientific Cloud, TEQIP-2 sponsored workshop on Heterogeneous computing, M S Ramaiah Institute of Technology (MSRIT), Bangalore, March 15, 2013.
10. Vineeth Simon Arackal, Cloud Security, CSI IT FEST -- INSPIRUS 13, New Horizon College of Engineering, Bangalore, March 21, 2013.
11. Dr. Prahlada Rao B.B., BiGData in High Performance Computing, International Workshop on Data Analytics & Applications (IWDAA-2013), BITS- Goa Campus, March 1, 2013.
12. Payal Saluja, On Demand Computing for Big Data, International conference of on demand computing (IODC2012), Oxford College of Engineering, Bangalore, November 16, 2012.
13. Dr. Prahlada Rao B.B., Cloud for Banking, 5th National Workshop on Telemedicine Today & Tomorrow, IDBRT – Mumbai, October 8, 2012.
14. Dr. Prahlada Rao B.B., C-DAC Scientific Cloud for Reserchers & Students, SecurIT 2012, Amrita Insititute of Technology, AmritaPuri Kollam, August 19, 2012.
15. Dr. Prahlada Rao B.B., Present and Future Complex Systems, International workshop on Next Generation Computing Systems, EU-INDIA Collaborations Project (EU-INCOOP), Indian Institute of Science (IISc) Bangalore, August 8, 2012.
16. Vineeth Simon Arackal, C-DAC Scientific Cloud, Indo-US Workshop on “Cloud Computing and Web Services” (CCWS2012), CIT, Coimbatore, August 9, 2012.
17. Vineeth Simon Arackal, Overview of Message Passing Interface, Intensive Course on Parallel Programming with MPI/OpenMP for Scientific Computing, CSIR-C-MMACS Bangalore, August 28, 2012.
18. Vineeth Simon Arackal & B.Arunachalam, Overview of Message Passing Interface and Advanced MPI, Parallel Computing Course, Indian Institute of Astrophysics, Bangalore, August 17-30, 2012.
19. S. Janakiraman, A Variable resolving global spectral method with finely resolved tropics, ICTS workshop on Advanced Dynamical Core Modeling of Atmosphere and Ocean Circulatios (ADCMAOC), National Atmospheric Research Laboratory, Gadanki, February 20, 2013.
20. S. Janakiraman, Some remarks on the seasonal forecasting of Indian summer monsoon, Brainstorming workshop on the forecast of Monsoon 2012, Ministry of Earth Sciences, New Delhi, March 26, 2013.
21. Karthika, Innovative Applications in Social Media, National Institute of Technology, Tiruchirappali, May 4, 2012.

22. Dr.Mohammed Misbahuddin, Security for e-Banking in the Refresher course for Teachers of Commerce and Management conducted by UGC-Academic Staff College, MANUU, Hyderabad, September 8, 2012.
23. BS Bindhumadhava, Cryptographty & Network Security issues at the faculty development program, Visvesvaraya Technical University, Belgaum, April 2012.
24. BS Bindhumadhava, Power Aware for HPC Research trends, Sri Vidhyaniketan College of Engineering, Tirupathi, May 18, 2012.
25. BS Bindhumadhava, Energy Internet Trends & Challenges, Dr. Ambedkar Institute of Technology, Bangalore, September 25, 2012.
26. BS Bindhumadhava, Research Trends in ICT, 4th National Conference on Emerging Trends in IT at Christ University, Bangalore, February 28, 2013.
27. M.Kumar, ICT for Differently Abled for M. Ed. students at NIMH Secunderabad, May 26, 2012.
28. Aakash Goel and Saleem, Layer8 Exploitation at cOcOn International Cyber Security and Policy Conference, Thiruvananthapuram, August 4, 2012.
29. Rajshekar and Aakash Goel, Application Security and Injection Flaws, "SecureIT" Internet of Things, International Security conference, August 18, 2012.
30. Mahesh U.Patil, Technologies for Next Generation Computing, National Conference on VLSI, Signal Processing and Embedded Systems (NC-Velasiem-2k12), VNR Vignan Jyothi College of Engineering, Hyderabad, August 29, 2012.
31. K.Suhasini and Rahul K, Web Application Security, Andhra Loyala Institute of Engineering and Technology, Vijayawada, September 4, 2012.
32. M.Kumar, Recent Advances in Mobile Computing Applications for e-Learning, Sri Vidyaniketan Engineering College, Tirupati on September 15, 2012.
33. M.Gnana Seelan, S.OmAarthi and J.Raghuram, Information Security, ECIL, October 13, 2012.
34. K.Indraveni and S.OmAarthi, Information Security for Civil Service officers, MCRHRD, October 15, 2012.
35. M.Gnana Seelan, S.OmAarthi and J.Raghuram, Information Security, ECIL, October 13, 2012.
36. Muralidharan V, New Horizon in Vehicle Telematics & Intelligent Transport Systems, Telematics India 2012, November 30, 2012.
37. M.Kumar, M-Learning Opputunities and Challenges, UGC sponsored training programme on “e-Learning” at UGC Academic Staff College, JNTUH, December 5, 2012.
38. Ramu Parupalli, Adaptable e-Learning, UGC sponsored training programme on “e-Learning” at UGC Academic Staff College, JNTUH, December 6, 2012.
39. P.R.Lakshmi Eswari, End Point Security, two-day workshop on “Research Aspects in Information Security”, JNTU Hyderabad, December 6-7, 2012.
40. M.Kumar, Open Source M-Learning and Multimedia Technologies for Education, FOSS-2012, December 14, 2012.
41. M.Kumar, Mobile & Ubiquitous Learning during National Seminar cum Workshop on ICT based learning in Higher Education, Centre for Distance and Virtual Learning (CDVL), University of Hyderabad(UoH), December 19, 2012.
42. Indraveni. K, Cloud Computing and Forensic, Andhra Pradesh Police Academy (APPA), Hyderabad, December 2012.
43. Ch A S Murty, Cyber laws and crimes, MCRHRD, Hyderabad, December 2012.
44. Indraveni, K, S. Om Aarathi and Nandeshwar, Information Security and Web application Security, MCRHRD, Hyderabad, December 2012.
45. Mahesh U.Patil, Internals of a Mobile Phone & Mobile OS : Developments & Security Issues”, Programme on Mobile Banking, Security and Testing (MBSAT)" IDRBT, Hyderabad, January 23, 2013.

46. Dr. M. Sasi Kumar, Personalized instruction in e- learning, IEEE International Conference on Technology for Education, T4E 2012, Hyderabad, July 18-20, 2012.
47. Santosh Kumar Soni, Recent Trends in Biometrics, Department of Computer Science, University of Mumbai.
48. Santosh Kumar Soni, Aadhaar Authentication System: An Overview, PricewaterhouseCoopers (PWC), Dadar, Mumbai, August 27, 2012.
49. Santosh Kumar Soni, Biometrics Authentication, Dr. B.M.N. College of Home Science SNDT, Matunga, May 2, 2012.
50. Pranaw Kumar, Working in Hindi with Latest Tools/Technologies, MTNL Mumbai March 6, 2013.
51. Pranaw Kumar, Working in Hindi with Open Source Technologies, IIT Bombay, Mumbai, March 19, 2013.
52. Repu Daman (Project Manager, SGPGI, Lucknow), Telemedicine and its Evolution, Telemedicine Schools (through VC), PGIMER Chandigarh, March 6, 2013.
53. Dr. Arti Noor, Basic VLSI Design, VLSI and Digital Image Processing, Delhi Technical University, New Delhi, 2-3, January 2013.
54. Dr. Arti Noor, Beyond Moor's Law: Facts and Future, MECON 2013, Amity school of engineering and Technology, Noida, January 17-18, 2013.
55. Sunitha Manjari K, Analysis of RNA-Seq data, Cancer Informatics Workshop, ACTREC (Kharghar), January 29, 2013.
56. Dr. Rajendra Joshi, New Trends in Bioinformatics, National Conference at IIT Delhi, July 30-31, 2012.
57. Dr. Uddhavesh Sonawane, Biomolecules in Motion, JNU, Delhi, January 4-5, 2013.
58. Dr. Uddhavesh Sonawane, Bioinformatics Conclave at Gujarat Cancer Research Centre, Ahmedabad, March 29, 2013.
59. Gaur Sunder, Developing eHealth Strategies to Deliver an Effective EHR System: India Case Study, eHealth Conference of CeBIT, Sydney, Australia, May 22-24, 2012.
60. Gaur Sunder, Taking Telemedicine to remote locations, Oditelecon 2012 Conference, Bhubaneshwar, Odisha, April 13-14, 2012.
61. Sunil L Londhe, Soil and Moisture Conservation Measures, Training of Trainers (TOT) on Soil and moisture conservation measures under NAP scheme in Pune/Junner region of Maharashtra, National Afforestation and Eco-Development Board Regional Centre (Mumbai), Karla, February 14, 2013.
62. Sandeep K Srivastava, Remote Sensing Application in Agriculture, Symbiosis Institute of Geoinformatics, Pune, January 12, 2013.
63. Sandeep K Srivastava, Remote Sensing Application in Agriculture, Department of Geography, University of Pune, January 14, 2013.
64. Dr. Manish P. Kale, Aranya - A comprehensive Spatial Decision Support System, UGC sponsored National Seminar on Improved Strategies in Sustained Biodiversity, P.B. Siddharth College, Vijaywada, February 28, 2013.
65. Dr. Dinesh Katre, UNESCO Sponsored Showcase Presentation on Centre of Excellence for Digital Preservation, UNESCO's Memory of the World in Digital Age, Vancouver, Canada, September 26-28, 2012.
66. Dr. Dinesh Katre, Keynote on Digital Preservation Development in India, Conference by Alliance for Permanent Access, European Space Agency, Frascati Italy, November 6-7, 2012.
67. Dr. Dinesh Katre, Digital Preservation of Media Libraries, National Conference of Association of Media Libraries and Archives on Managing Indian Media Libraries and Archives organized by UNESCO and JNU, February 4-5, 2013.
68. Akshat Joshi, IDNs – Unity in Diversity – Indian Response (Theme: Internet Governance – Lessons Learnt and Road Ahead), GIGA International conference, Hyderabad, April 5-6, 2012.

69. Rajat Gupta, Web Service handshake with GIST-Connect & XLIFF, IIIT Hyderabad 2013.
70. P. Ravikumar, Area Traffic Control System and ICTE in ITS, Staff Development Program, St. Peter's College of Engineering and Technology, Chennai, April 11, 2012.
71. Aby Joseph and Saravanakumar, Industrial Applications of Power Electronics, Workshop organized by IEEE Students Chapter, TKM Engineering College, Kollam, June 30, 2012.
72. Aby Joseph, Synchrophasor initiatives in India, Power Grid Corporation of India Limited (PGCIL), New Delhi, July 30, 2012.
73. P. Ravikumar, Indigenous ITS Solutions, Urban Development Vision 2020, Goa, September 5-6, 2012.
74. P. Ravikumar, ITS in India and C-DAC's initiatives, Workshop on ITS Architecture for Hyderabad, Hyderabad Metropolitan Development Authority (HMDA), Hyderabad, September 13, 2012.
75. Ravikumar P, C-DAC's initiatives in ITS, Wrap-up meeting of Japan International Cooperation Agency (JICA) ITS Architecture for India study, New Delhi, September 25, 2012.
76. Dr. Z.V. Lakaparampil, Recent Trends in Power Electronics & Drives, College of Engineering, Thiruvananthapuram, October 29 - November 2, 2012.
77. Chandrasekar V, Recent Trends in SMPS Design, College of Engineering, Thiruvananthapuram, November 2, 2012.
78. Aby Joseph and Jinuraj K.G, Design of Controller for Grid Connected Power Converters, short-term course jointly organized by NaMPET and College of Engineering, Thiruvananthapuram, December 17-19, 2012.
79. P. Ravikumar, Intelligent Transportation System, MET'S Schools of Engineering, Mala, January 10, 2013.
80. P. Ravikumar, ITS in India and ITS Toolkit, Workshop on Financing and ITS Toolkit, Institute of Urban Transport, Delhi, February 21-22, 2013.
81. Saravana Kumar, Grid connected inverter for Pad Renewable Energy Sources, Vellore Institute of Technology (VIT), Chennai Campus, March 16, 2013.
82. Saravana Kumar, Power Quality Issues at IT Park-Shunt Active Filter, TEQIP (Technical Education Quality Improvement Programme), College of Engineering, Kasargod, March 20, 2013.
83. Lakshmi K.R, Design and Implementation of Solar Power Electronic Converters, College of Engineering, Calicut, March 27, 2013.
84. Brijesh P, Synchronized Phasor Measurement Unit for Power System Wide Area Monitoring, College of Engineering, Calicut, March 27, 2013.
85. Nabeel Koya A, Cryptography and Digital Signatures, Institute of Management in Government (IMG), Thiruvananthapuram; May 8, 2012; May 17, 2012; June 7, 2012; June 26, 2012.
86. Nabeel Koya A, Cyber Security, Institute of Management in Government (IMG), Thiruvananthapuram, July 12, 2012.
87. Satheesh Kumar S, Cyber Forensics, Data Security Council of India at Forensic Science Laboratory, Gandhinagar, Gujarat, July 21, 2012.
88. Bhadran V K, Network Forensics, Cocon-International Cyber Security and Policing Conference, organized by Kerala Police and Information Security Research Association, Vivanta by Taj, Thiruvananthapuram, August 3-4, 2012.
89. Satheesh Kumar S, C-DAC Cyber Forensics Solutions, Naval Provost and Regulating School, Goa, August 6-7, 2012.
90. Nabeel Koya A, Cryptography, Institute of Management in Government (IMG), Thiruvananthapuram, August 8, 2012.
91. K. L. Thomas, Cyber Forensics, Navy Signal School, Kochi, September 29, 2012.
92. Satheesh Kumar S, Cyber Forensics, Training programme conducted by Forensic Science Laboratory, Thiruvananthapuram; July 7 & 25, 2012; August 18, 2012; September 15, 2012; November 2, 2012.

93. Satheesh Kumar S, Cyber Forensics – an overview and demo of C-DAC tools and Case Study, Forensic Science Laboratory, Thiruvananthapuram, January 17, 2013; February 14, 2013; March 21, 2013.
94. Satheesh Kumar S, C-DAC Cyber Forensics Solutions, IDRBT, Hyderabad, January 29, 2013.
95. Balan C, Recent trends & Advancements in Cyber Forensics, Confederation of Indian Industry, Kochi, January 31, 2013.
96. Balan C, Cyber Forensics, Systematic Approach to Digital Forensics, Forensic Science Laboratory, Chennai, February 26, 2013.
97. Satheesh Kumar S, Cyber forensics and Security, Government Engineering College, Wayanadu, March 1, 2013.
98. Nabeel Koya, Computer Forensics, IEEE Kochi, March 16, 2013.
99. Satheesh Kumar S, Cyber Security and Forensics, College of Engineering, Thiruvananthapuram, March 25, 2013.
100. Sudhamony S, Tele Health System in Kerala, State Level Workshop on Tele health in Health Services Dept, Kerala, Directorate of Health Services, November 27, 2012.
101. C Sudalaimani, e-Health in Kerala, TKM Institute of Technology, Kollam, Kerala, March 1, 2013.
102. Selina H, Foss and BOSS, broadcast (Medium wave 1161 KHz) in the Science program, December 18, 2012.
103. Bhadran V.K, Introduction to language computing, Central University, Kasaragode, February 19, 2013.
104. Jayan V, Machine Aided Translation, Central University, Kasaragode, February 19, 2013
105. Jose Stephen, Introduction to Automatic Speech Recognition and Text-to-Speech Systems, Central University, Kasaragode, February 19, 2013.
106. Anjali, Interactive Newspaper Reading System, Kerala Science Congress, March 14, 2013.
107. Sajini T, Text-to-Speech, College of Engineering Thiruvananthapuram, March 18-22, 2013.
108. Jose Stephen, Automatic Speech Recognition System, College of Engineering Thiruvananthapuram, March 18-22, 2013.
109. Muraleedharan N, Network monitoring and security Analysis at Technical Work- shop on NKN, April 18, 2012.

Human Resource Development

Being an R&D organization, the knowledge capital implanted and nurtured across the organization is a vital determinant for the success of the organization. C-DAC's HRD initiatives are focused on facilitation of induction and enhancement of 'knowledge capital' and optimum deployment of knowledge and skills supported by a favorable environment. HR function at C-DAC strives to facilitate 'free thoughts' and 'innovation' in the areas of organizational interest. Pan C-DAC initiatives like "idea hunt" by Thiruvananthapuram center, thematic technological conclaves by Noida and Hyderabad centers, etc. had served in these lines during the year. While these initiatives contributed in knowledge enhancement, activities such as Sports meet at C-DAC, Mohali during January - February, 2013, Cultural meet at Pune during October, 2012, Literary competitions during January-February, 2013, etc. helped in sustaining the excellent organizational climate and inculcating sense of belongingness and bonding among C-DACians. These events were participated by employees across C-DAC and their family members.

Identification and bridging of knowledge and skill gaps forms one of the prime tasks of HRD function. A total of over 4000 man days of structured training was imparted to employees across C-DAC during 2012-13, in addition to nominating employees to various national and international conferences.

Carving suitable HR policies to facilitate increased employee engagement, resulting in enhanced outputs had been the major contribution from the HR perspective.

Implementation of iHRMS (an integrated Human Resource Management System), which enabled the HR management of entire C-DAC in a single platform, is one of the most fruitful endeavors during the year. The system has laid the baseline for establishing uniform HR practices transparently.

Spread of HR

The human resources in C-DAC are spread into four categories between Scientific and Technical (S&T) and Non S&T.

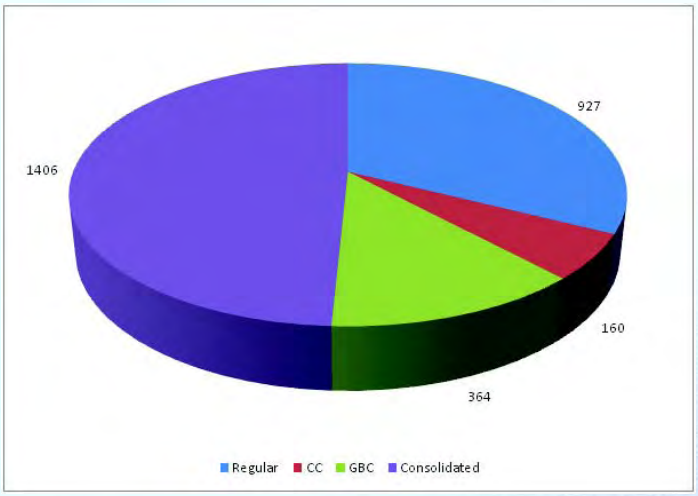
i. Regular

ii. Continuing Contract

iii. Grade Based Contract

iv. Contract on Consolidated Pay

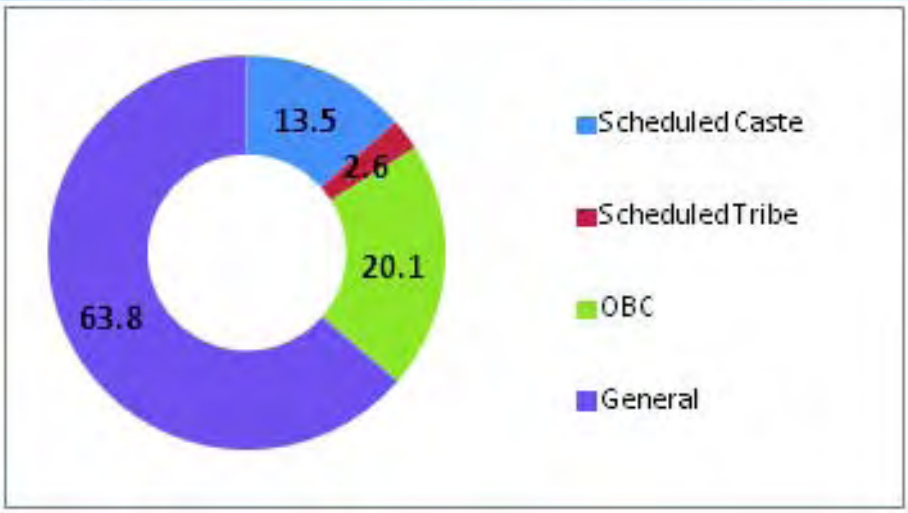
The strength and distribution of staff in various categories as on 31st March 2013 are given below.



Strength and distribution of staff in various categories as on 31st March 2013

Representation of Scheduled Caste, Scheduled Tribe and Other Backward Communities

C-DAC has always ensured that the statutory requirements in terms of reserved categories are complied with, in every recruitment projects. During 2012-13, C-DAC initiated a national level 'Special Recruitment Drive' to fill all the backlog vacancies as on January 2012, in the reserved categories. Currently, the reserved categories are well represented in the organization and are expected to be better on completion of the Special Recruitment Drive.



Representation of Scheduled Caste, Scheduled Tribe and other backward communities

Initiatives on Card for Implementation during the Forthcoming Year

- C-DAC Sponsored Higher Education Scheme
- Knowledge sharing and interaction forums
- Knowledge Refresher meets – Thematic Areas
- Innovation nurturing facilities
- Personal Effectiveness Enhancement Programmes

LEGAL and IPR

The main functions of Legal and IPR department are:

- Drafting/vetting of MOUs, Contracts, Tenders etc.
- Providing legal advice/opinion/legal action by/against C-DAC
- Providing IPR related advice and services

The activities carried out during the year by Legal and IPR department are listed below.

1. A project entitled "Establishment of Patent Search Centre to be implemented by C-DAC, Pune" was successfully completed. Under this project, following services were offered and availed by the users registered on web portal **http://ict-ipr.cdac.in**.

   - Patent Prior Art Search
   - Invention Analysis
   - Reply to queries related to Intellectual Property Rights
   - Patent Alerts

   These services have been well received by both internal and external users, including those from IISc, COEP, etc. More than 650 users have registered on the portal.

   Feedback was sought from 405 users out of which 143 responded. The analysis of the feedback received shows that 35% respondents have rated the services as outstanding (5/5) and 36% have rated it as excellent (4/5).

2. Apart from drafting/ vetting several contracts/ MOUs, the Legal and IPR department also organized IPR awareness programmes on patent search at Pune, Mohali and Chennai centres of C-DAC. Such awareness programmes help and encourage our employees to file patent/ copyright/trademark applications for their work.

3. During the year, Mr. R.Y. Deshpande, Director (Legal and Contracts) delivered invited talk on IPR, Cyber law, etc. at NITTR (5 times), DOEACC (2 times), IIIT, Allahabad (once), Modern College, Pune (6 times) and all C-DAC centres (through K-point web conferencing system).

4. Guided Knowledge Management Cell in streamlining and updating records by initiating follow-up in respect of patents, copyrights and trademarks.

Right to Information (RTI)

C-DAC is a public body as provided in Section 2(h) of the RTI Act. Request for information under RTI Act can either be filed at any of the locations of C-DAC or can be submitted online through the RTI module. Mandatory disclosures as per the guidelines of Sec 4(1)(b) have been published in the RTI module on C-DAC's website. The same is updated periodically.

All RTI applications received during the financial year 2012-13, were duly processed.

ISO Implementation

As per the directives of DeitY, C-DAC is required to implement ISO: 9001-2008. Accordingly, implementation of Quality Management System (QMS) as per ISO 9001:2008 was initiated at Corporate Office of C-DAC during December 2012.

Financials

Handing over of the Audited Annual Accounts of C-DAC to
Prof. Rajat Moona, Director General, C-DAC by the Auditors

INDEPENDENT AUDITOR'S REPORT

To
The Members,
Governing Council,
Centre for Development of Advanced Computing,
Pune University Campus,
Pune - 411 007.

Report on the Financial Statements

We have audited the accompanying consolidated financial statements of Centre for Development of Advanced Computing (C-DAC), which comprise the consolidated Balance Sheet as at March 31, 2013, and the consolidated Income & Expenditure Account and the consolidated Receipts & Payment Account for the year then ended, and a summary of significant accounting policies and other explanatory information

Management's Responsibility for the Consolidated Financial Statements

Management is responsible for the preparation of these consolidated financial statements that give a true and fair view of the consolidated financial position, consolidated financial performance and consolidated receipts and payment of the Institute in accordance with accounting principles generally accepted in India. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation and presentation of the consolidated financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these consolidated financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free from material misstatement. An audit involves performing procedures to obtain audit evidence about the amounts and disclosures

in the consolidated financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the consolidated financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Institute's preparation and presentation of the consolidated financial statements that give a true and fair view in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

(a) We further report that:

i. **We have not audited the financial statements of Bangalore, Delhi, Hyderabad, Kolkata, Mohali, Noida, Thiruvananthapuram and Chennai Centre's whose financial statements reflect total assets of Rs.46,009.84 lacs as at 31.03.2013 and total revenues of Rs.11,235.91 lacs for the year then ended. These financial statements have been audited by other auditor's, whose reports have been furnished to us, and our opinion, in so far as it relates to the amounts included in respect of these Centre's, is based on the reports of such other auditor's and is subject to the note No. 18 of Schedule 19, wherein Centre specific notes are disclosed.**

ii. The Institute has made provision of Rs.1,405.93 lacs upto 31st March, 2013 for bad & doubtful debts outstanding for the period more than three year. The Provision as made is adequate as per the opinion of the Management.

iii. Balances of Debtors, Creditors, Current Assets, Loans & Advances and Current Liabilities are subject to confirmation and further reconciliation, if any. The extent of adjustment that may arise and their effect on accounts is not ascertainable as this stage.

(b) In our opinion and to the best of our information and according to the explanations given to us, the said accounts read with the notes to accounts and subject to note nos. 1, 4, 5, 8,9,10,11,12, 13 and note no.18 regarding Centre specific notes of Schedule 19.

In our opinion and to the best of our information and according to the explanations given to us, the consolidated financial statements give a true and fair view in conformity with the accounting principles generally accepted in India:

(a) in the case of the consolidated Balance Sheet, of the state of affairs of the Institute as at March 31, 2013;

(b) in the case of the consolidated Income and Expenditure, of the Surplus for the year ended on that date; and

(c) in the case of the consolidated Receipts & Payments Account, of the Receipts & Payment for the year ended on that date

For M/S Patil Ranadive & Associates
Chartered Accountants
FR no. 107816W

J. J. RANADIVE
Partner
M.No. 032953

Date : 24th September , 2013.
Pune : Pune.

CONSOLIDATED BALANCE SHEET AS AT 31st March 2013

Amount in ₹

Particulars	Schedule	2012-2013	2011-2012
CORPUS/CAPITAL FUND AND LIABILITIES			
Corpus/Capital Fund	1	2,67,55,43,823	2,32,70,50,797
Reserves and Surplus	2	1,49,61,45,494	1,33,87,56,405
Earmarked and Endowment Funds	3	1,64,38,08,847	2,54,77,87,416
Secured Loan from Bank		13,50,00,000	14,50,00,000
Current Liabilities and Provisions	4	1,05,07,45,811	96,02,54,090
Branch & Divisions		-	-
Total		**7,00,12,43,975**	**7,31,88,48,708**
ASSETS			
Fixed Assets			
Acquired out of Own Funds	5	34,66,05,662	36,31,25,176
Acquired out of Grant in Aid	6	1,26,96,58,226	1,14,24,01,107
Acquired out of Project Grants	7	22,64,87,268	19,63,55,298
Investments-from Earmarked/Endowment Funds		-	-
Investments-Others		-	-
Current Assets, Loans, Advances etc.	8	5,15,84,92,819	5,61,69,67,127
Miscellaneous Expenditure		-	-
Total		**7,00,12,43,975**	**7,31,88,48,708**

Significant Accounting Policies, Notes to Accounts and Schedules form an integral part of the Balance Sheet.

CA Raghu Bhargava
Director (Finance)

R.Y. Deshpande
Registrar

Prof. Rajat Moona
Director General

AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
FOR PATIL RANADIVE & ASSOCIATES (FR NO. 107816W)
CHARTERED ACCOUNTANTS

Janardan Ranadive
Partner (Membership Number 032953)
Pune

Date : 24-Sep-2013

Income and Expenditure Account for the year ending 31st March 2013

Amount in ₹

Particulars	Schedule	2012-2013	2011-2012
INCOME			
Income from Sales/Services	9	41,46,48,333	59,21,36,071
Grants/Subsidies	10	91,68,85,506	82,59,54,084
Fees/Subscription	11	56,35,79,006	57,56,12,023
Income from Investments (Income on Investments from earmarked/endowment funds transferred to funds)	12	-	-
Interest Earned	13	20,81,89,813	17,00,49,661
Other Income	14	2,13,61,075	2,27,58,476
Prior Period Income		2,27,21,542	23,14,063
Increase/(decrease) in stock of Finished Goods and Work-in-progress	15	(10,58,863)	(2,32,58,880)
TOTAL (A)		**2,14,63,26,412**	**2,16,55,65,498**
EXPENDITURE			
Establishment Expenses	16	96,16,89,246	84,49,59,955
Other Administrative Expenses	17	62,03,71,885	72,21,20,604
Prior Period Expenses		1,63,59,875	(25,15,067)
Depreciation (corresponding to Schedule 5)		3,63,51,938	3,74,26,678
TOTAL (B)		**1,63,47,72,944**	**1,60,19,92,170**
Transferred to / (from) Balance of Mission Grants		10,50,60,933	9,94,63,588
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CORPUS/CAPITAL FUND		**40,64,92,535**	**46,41,09,740**
SIGNIFICANT ACCOUNTING POLICIES	18		
CONTINGENT LIABILITIES AND NOTES TO ACCOUNTS	19		

Significant Accounting Policies, Notes to Accounts and Schedules form an integral part of the Balance Sheet.

CA Raghu Bhargava
Director (Finance)

R.Y. Deshpande
Registrar

Prof. Rajat Moona
Director General

AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
FOR PATIL RANADIVE & ASSOCIATES (FR NO. 107816W)
CHARTERED ACCOUNTANTS

Janardan Ranadive
Partner (Membership Number 032953)
Pune

Date : 24-Sep-2013

Amount in ₹

Particulars	2012-2013	2011-2012
Schedule 1 - Corpus/Capital Fund		
Balance as at the beginning of the year	2,32,70,50,797	2,22,12,22,932
Add: Surplus as per Income & Expenditure Account	40,64,92,535	46,41,09,740
Less : Own contribution to Core / Projects and Other Adjustments / Transfers	5,79,99,509	35,82,81,875
Balance as at the year - end	**2,67,55,43,823**	**2,32,70,50,797**
Schedule 2 - Reserves and Surplus		
1. Capital Reserve :		
As per last Account	1,33,87,56,405	99,49,73,299
Addition during the year	46,53,12,485	52,79,71,064
Less : Deductions during the year	30,79,23,396	18,41,87,958
Total	**1,49,61,45,494**	**1,33,87,56,405**
Schedule 3 - Earmarked/Endowment Funds		
1. Balance of Core Grants		
a) Opening balance of the funds	15,37,94,472	3,61,58,616
b) Additions to the Funds		
I) Donations/Grants	97,91,00,000	86,52,00,000
II) Income from Investments made on account of funds	4,54,18,739	1,81,72,267
III) Other additions (C-DAC Contribution and Other Income)	87,64,333	76,57,842
Total (b)	1,03,32,83,072	89,10,30,109
Total (a)+(b)	1,18,70,77,544	92,71,88,725
c) Utilization/Expenditure towards objectives of funds		
I) Capital Expenditure		
Fixed Assets	6,22,14,494	3,92,45,916
Others	-	-
Total I	6,22,14,494	3,92,45,916
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	62,35,86,508	55,18,01,051
Componants, Consumables and Other Direct Expenses	94,61,720	68,38,246
Travel	1,28,25,676	1,64,54,770
Contingencies, Overheads and Other Administrative Expenditure	17,47,15,002	15,90,54,270
Total II	82,05,88,906	73,41,48,337
Total (c)	88,28,03,400	77,33,94,253
Net Balance as at Year - End (a+b-c) Total 1	30,42,74,144	15,37,94,472
Projects wise Allocated Core Grant (Annexure 1)		
d) Opening balance	1,24,15,73,078	85,20,40,054
e) Additions to the Funds		
I) Donations/Grants	16,19,65,000	75,66,81,898
II) Income from Investments made on account of funds	6,13,70,062	3,92,81,603
III) Other additions (C-DAC Contribution and Other Income)	6,25,51,072	35,89,80,050
Total (e)	28,58,86,134	1,15,49,43,551
Total (d)+(e)	1,52,74,59,212	2,00,69,83,605

Amount in ₹

Particulars	2012-2013	2011-2012
f) Utilization/Expenditure towards objectives of funds		
I) Capital Expenditure		
Fixed Assets	23,72,09,688	38,56,46,736
Others	-	-
Total I	23,72,09,688	38,56,46,736
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	34,47,37,048	21,94,13,591
Componants, Consumables and Other Direct Expenses	6,93,39,998	6,10,86,969
Travel	2,76,01,000	1,73,75,438
Contingencies, Overheads and Other Administrative Expenditure	16,05,34,384	8,11,96,073
Total II	60,22,12,430	37,90,72,071
Total Expenditure (f)	83,94,22,118	76,47,18,807
g) Refund / Transfer and Other Adjustments	23,49,54,011	6,91,720
Net Balance as at Year - End (d+e-f-g) Total 2	45,30,83,083	1,24,15,73,078
Core Grant Balance as at Year - End (Total 1 + Total 2) Total 3	75,73,57,227	1,39,53,67,550
2. Balance of Unutilized Funded Project Grants (Annexure 2)		
a) Opening balance of the funds	1,14,88,76,365	1,11,31,78,266
b) Additions to the Funds		
I) Donations/Grants	1,05,74,49,409	1,26,25,23,613
II) Income from Investments made on account of funds	6,29,22,183	5,54,33,948
III) Other additions (C-DAC Contribution and Other Income)	9,28,41,183	9,73,39,046
Total (b)	1,21,32,12,775	1,41,52,96,607
Total (a)+(b)	2,36,20,89,140	2,52,84,74,873
c) Utilization/Expenditure towards objectives of funds		
I) Capital Expenditure		
Fixed Assets	16,60,04,302	10,30,06,720
Others	-	-
Total I	16,60,04,302	10,30,06,720
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	52,70,43,211	54,94,74,277
Componants, Consumables and Other Direct Expenses	20,14,44,313	40,43,02,347
Travel	6,02,43,656	6,55,10,650
Contingencies, Overheads and Other Administrative Expenditure	44,55,42,659	22,73,05,580
Total II	1,23,42,73,839	1,24,65,92,854
Total (c)	1,40,02,78,141	1,34,95,99,574
d) Refund / Transfer and Other Adjustments	7,92,29,787	2,99,98,934
Net Balance as at Year - End (a+b-c-d) Total 4	88,25,81,212	1,14,88,76,365
3. Employee and Other Funds:		
As per last Account	35,43,501	36,92,312
Addition during the year	3,26,907	4,27,319
Less : Deductions during the year	-	5,76,130
Total (5)	38,70,408	35,43,501
Grand Total (Total 3+ Total 4+Total 5)	**1,64,38,08,847**	**2,54,77,87,416**

Annexure 1 of Schedule 3 **Projects wise Allocated Core Grant**
(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

Sr.No.	Name of the Project	Opening Balance	Grants Received During the year	Interest Earned	Other Income & CDAC's Contribution During the year	Capital Expenditure	Salary, Wages Allowances etc.	Componants, Consumables and Other Direct Expenses	Travel	Contingencies, Overheads and Other Administrative Expenditure	Total Expenses	Refund / Transfer & Other Adjustments	Closing Balance
1	Acoustic Mine Detection System - MK2	3,54,160	-	-	-	4,25,180	1,15,80,000	29,82,360	4,64,417	56,28,048	2,10,80,005	(1,72,80,000)	(34,45,845)
2	Autonomic Real Time Multiprotocol Gateway	13,25,510	57,65,000	93,842	3,25,712	7,31,534	45,71,596	2,00,000	3,63,092	7,70,000	66,36,222	-	8,73,842
3	Building a Pan-C-DAC Cloud Computing Framework	11,68,88,593	-	4,69,347	-	1,41,99,007	3,30,08,736	81,01,012	48,68,586	2,61,50,372	8,63,27,713	3,68,15,601	(57,85,374)
4	Building Fund	10,34,19,521	-	22,43,771	6,22,25,360	6,17,04,459	4,73,600	-	89,532	21,965	6,22,89,556	10,55,99,096	-
5	Development of E-Agrin Projects	-	-	-	-	-	-	-	-	-	-	-	-
6	E-Learning Solutions in Areas of Automated Grading & Analysis of Software Programs	4,72,77,466	-	(6,828)	-	82,54,083	1,20,72,545	10,05,319	9,37,912	28,40,571	2,51,10,430	2,30,39,953	(8,79,745)
7	E-Securities Initives Related to Security for USB Date Drives Automated Web Application Security Assessment Framework	4,11,19,785	-	5,73,846	-	69,56,800	1,05,89,869	13,70,332	8,73,883	79,31,551	2,77,22,435	1,68,32,289	(28,61,093)
8	HTDG 40 TF Project	45,972	-	-	-	-	-	-	-	-	-	45,972	-
9	IP Awarness in E&IT Sector	31,39,358	-	-	-	3,62,900	54,70,232	1,57,080	12,38,771	19,15,994	91,44,977	-	(60,05,619)
10	Mobile Computing and Applications	5,07,25,135	-	2,17,442	-	70,61,274	2,39,56,034	33,94,640	18,45,519	86,23,888	4,48,81,355	1,40,90,674	(80,29,452)
11	National Grid Computing Initiative - GARUDA - Foundation Phase	-	-	-	-	-	-	-	-	-	-	-	-
12	National Grid Computing Initiative - GARUDA - Grid Technology Services for operational Phase of Garuda	18,33,80,949	-	97,47,469	-	37,98,760	4,02,56,040	1,55,05,199	40,16,747	1,33,74,107	7,69,50,853	-	11,61,77,565
13	North East Projects	12,92,11,928	-	64,01,830	-	9,43,660	2,01,43,670	1,82,72,761	40,10,017	1,69,84,577	6,03,54,685	66,50,254	6,86,08,819
14	Pan C-DAC Knowledge & Resource Management Lab (PCKRML)	1,66,66,574	-	-	-	-	-	-	-	-	-	1,66,67,000	(426)
15	Pan C-DAC Research Initive in Perception Engineering	3,94,21,283	-	7,10,990	-	78,216	1,47,74,050	45,49,890	18,97,556	44,47,881	2,57,47,593	1,18,75,000	25,09,680
16	Power Optimization of HPC Sys & Facilities	5,08,20,664	-	45,371	-	35,75,951	1,90,80,706	42,31,907	4,95,435	58,48,640	3,32,32,639	1,51,27,974	25,05,422
17	Sixth Pay Commission Arrears	-	-	-	-	-	-	-	-	-	-	-	-
18	Speed Post Bags Tracking RFID Barcode Tags	16,83,000	-	16,066	-	-	-	-	-	-	-	16,99,066	-
19	Trainers Training and Students Talent Transfor	1,58,43,180	-	9,44,709	-	1,16,467	98,02,761	-	3,89,134	25,55,590	1,28,63,952	54,22,707	(14,98,770)
20	Speech to Speech MAT Based Dialogue Sys. From Hindi To Indian Language	5,51,10,000	-	57,08,000	-	99,000	2,46,96,313	1,54,189	9,18,666	41,24,922	2,99,93,090	(8,832)	3,08,33,742
21	Dev. & Adaption of applications, System S/W & H/W Tech. for Hybrid Archi.Based HPC System	6,60,50,000	-	68,40,000	-	64,91,147	3,01,77,586	45,50,078	12,39,975	86,67,527	5,11,26,313	(9,08,702)	2,26,72,389
22	Provisioning of Hybrid Tech. in NPSF and CTSF - A Step towards Next Generation HPC	5,83,00,000	5,51,40,000	-	-	11,47,54,332	1,15,01,274	8,980	1,10,404	2,85,90,197	15,49,65,187	-	(4,15,25,187)
23	Advance Research in Ubiquitous Computing through C-DAC's Ubiquitous Computing Res. Centers	5,18,46,000	-	53,70,000	-	42,86,770	1,30,31,306	31,13,814	14,53,864	32,16,486	2,51,02,240	(3,94,482)	3,25,08,242
24	Design & Dev. Of a Unified Threat Management Solution (UTM)	5,64,44,000	-	61,29,788	-	16,27,871	87,42,406	3,44,437	11,94,228	19,32,251	1,38,41,193	-	4,87,32,595
25	BOSS Support Centres and Business Dev. (Ph II)	6,82,33,000	-	71,00,199	-	5,54,465	2,22,60,071	6,33,076	5,46,363	37,62,813	2,77,56,788	(3,28,559)	4,79,04,970
26	Development of Advanced tools for Cloud Security Transactions	91,91,000	-	9,88,220	-	7,99,260	12,41,253	58,525	64,522	2,45,723	24,09,283	-	77,69,937
27	Centre of Excellence in Smart Card Technology	3,75,61,000	-	38,90,000	-	1,00,659	1,32,86,000	3,44,571	3,98,051	76,53,801	2,17,83,082	-	1,96,67,918
28	Design & Development of a Rapid Product Dev. Platform	1,90,00,000	-	19,68,000	-	-	59,14,000	61,828	86,110	36,99,362	97,61,300	-	1,12,06,700

Annexure 1 of Schedule 3 **Projects wise Allocated Core Grant**
(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

Sr.No.	Name of the Project	Opening Balance	Grants Received During the year	Interest Earned	Other Income & CDAC's Contribution During the year	Capital Expenditure	Salary, Wages Allowances etc.	Componants, Consumables and Other Direct Expenses	Travel	Contingencies, Overheads and Other Administrative Expenditure	Total Expenses	Refund / Transfer & Other Adjustments	Closing Balance
29	OCR Sys. On Android based Handheld Devices using Multi Framework for Malayam,Bangla,Punjabi,Hindi,Urdu,Tamil & Telugu	46,69,000	-	4,84,000	-	36,000	29,10,000	-	68,858	6,81,118	36,95,976	-	14,57,024
30	Ubiquitous Speech Collection & Analysis System for Surveillance Application (USCAS)	1,38,46,000	-	14,34,000	-	2,51,893	51,97,000	3,00,000	29,358	8,67,000	66,45,251	-	86,34,749
31	Core Grant Project - Corporate	-	10,10,60,000	-	-	-	-	-	-	-	-	9,000	10,10,51,000
	Total	1,24,15,73,078	16,19,65,000	6,13,70,062	6,25,51,072	23,72,09,688	34,47,37,048	6,93,39,998	2,76,01,000	16,05,34,384	83,94,22,118	23,49,54,011	45,30,83,083

Annexure 2 of Schedule 3 **Funded Projects**
(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

Sr.No.	Name of the Project	Opening Balance	Grants Received During the year	Interest Earned	Other Income & CDAC's Contribution During the year	Capital Expenditure	Salary, Wages Allowances etc.	Componants, Consumables and Other Direct Expenses	Travel	Contingencies, Overheads and Other Administrative Expenditure	Total Expenses	Refund / Transfer & Other Adjustments	Closing Balance
1	Bangalore Centre												
	DIT Projects	7,38,41,881	2,81,40,000	15,99,562	-	4,26,04,550	3,08,92,633	42,26,496	30,56,251	1,59,21,913	9,67,01,843	(1,40,98,501)	2,09,78,101
	Other Agency Projects	8,30,062	38,61,057	27,888	-	-	2,59,548	-	1,36,318	65,922	4,61,788	-	42,57,219
	Total Bangalore Centre	7,46,71,943	3,20,01,057	16,27,450	-	4,26,04,550	3,11,52,181	42,26,496	31,92,569	1,59,87,835	9,71,63,631	(1,40,98,501)	2,52,35,320
2	Chennai Centre												
	DIT Projects	2,99,52,932	11,54,06,000	58,26,260	-	48,31,092	3,96,28,154	4,04,325	27,71,452	3,40,96,899	8,17,31,922	-	6,94,53,270
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Chennai Centre	2,99,52,932	11,54,06,000	58,26,260	-	48,31,092	3,96,28,154	4,04,325	27,71,452	3,40,96,899	8,17,31,922	-	6,94,53,270
3	Corporate Office												
	DIT Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Corporate Office	-	-	-	-	-	-	-	-	-	-	-	-
4	Delhi Centre												
	DIT Projects	59,69,371	5,58,621	11,000	-	-	21,37,740	-	40,187	51,01,768	72,79,695	-	(7,40,703)
	Other Agency Projects	8,28,91,816	7,07,87,360	-	-	-	3,84,200	3,08,63,894	35,60,107	1,41,23,059	4,89,31,260	1,16,40,926	9,31,06,990
	Total Delhi Centre	8,88,61,187	7,13,45,981	11,000	-	-	25,21,940	3,08,63,894	36,00,294	1,92,24,827	5,62,10,955	1,16,40,926	9,23,66,287
5	Hyderabad Centre												
	DIT Projects	8,87,71,319	8,13,85,000	53,66,097	1,42,400	2,92,00,068	3,11,49,846	40,40,058	63,58,239	2,99,62,193	10,07,10,404	11,39,074	7,38,15,338
	Other Agency Projects	1,956	-	-	-	-	-	-	-	1,956	1,956	-	-
	Total Hyderabad Centre	8,87,73,275	8,13,85,000	53,66,097	1,42,400	2,92,00,068	3,11,49,846	40,40,058	63,58,239	2,99,64,149	10,07,12,360	11,39,074	7,38,15,338
6	Kolkata Centre												
	DIT Projects	16,32,37,906	4,35,92,000	54,47,180	-	-	3,56,65,020	3,74,83,382	85,75,742	1,19,87,710	9,37,11,854	2,11,20,185	9,74,45,047
	Other Agency Projects	1,70,60,850	1,06,02,646	9,04,812	470	-	84,48,754	33,25,775	12,06,175	6,99,501	1,36,80,205	35,09,558	1,13,79,015
	Total Kolkata Centre	18,02,98,756	5,41,94,646	63,51,992	470	-	4,41,13,774	4,08,09,157	97,81,917	1,26,87,211	10,73,92,059	2,46,29,743	10,88,24,062
7	Mohali Centre												
	DIT Projects	1,23,58,030	1,44,35,000	6,50,789	-	59,36,706	1,11,68,522	16,77,593	9,07,214	53,52,154	2,50,42,189	-	24,01,630
	Other Agency Projects	31,69,445	3,61,70,000	28,80,000	1,22,700	97,500	-	1,69,471	59,956	31,55,468	34,82,395	-	3,88,59,750
	Total Mohali Centre	1,55,27,475	5,06,05,000	35,30,789	1,22,700	60,34,206	1,11,68,522	18,47,064	9,67,170	85,07,622	2,85,24,584	-	4,12,61,380
8	Mumbai Centre												
	DIT Projects	10,98,05,985	3,81,67,000	23,83,000	-	1,45,94,701	1,99,37,902	19,32,568	45,66,506	3,02,71,254	7,13,02,931	2,03,52,295	5,87,00,759
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Mumbai Centre	10,98,05,985	3,81,67,000	23,83,000	-	1,45,94,701	1,99,37,902	19,32,568	45,66,506	3,02,71,254	7,13,02,931	2,03,52,295	5,87,00,759
9	Noida Centre												
	DIT Projects	4,36,68,568	4,72,52,000	14,94,275	-	32,03,589	4,61,51,356	1,07,01,577	30,98,197	2,18,86,439	8,50,41,158	41,20,000	32,53,685
	Other Agency Projects	17,16,043	55,37,000	-	-	-	-	-	-	-	-	26,928	72,26,115
	Total Noida Centre	4,53,84,611	5,27,89,000	14,94,275	-	32,03,589	4,61,51,356	1,07,01,577	30,98,197	2,18,86,439	8,50,41,158	41,46,928	1,04,79,800
10	Pune Centre												
	DIT Projects	8,73,42,789	19,97,73,000	29,15,248	8,61,992	3,03,65,526	12,10,75,078	39,63,239	84,60,295	4,78,18,766	21,16,82,904	32,66,476	7,59,43,649
	Other Agency Projects	(1,47,84,940)	3,44,10,336	5,21,308	-	43,40,045	68,28,609	81,56,218	8,74,649	22,73,775	2,24,73,296	-	(23,26,592)
	Total Pune Centre	7,25,57,849	23,41,83,336	34,36,556	8,61,992	3,47,05,571	12,79,03,687	1,21,19,457	93,34,944	5,00,92,541	23,41,56,200	32,66,476	7,36,17,057
11	Thiruvananthapuram Centre												
	DIT Projects	38,57,78,181	23,04,39,435	1,70,23,323	18,60,000	2,99,95,590	11,57,40,727	5,29,14,962	1,40,98,154	19,85,06,120	41,12,55,553	2,19,84,916	20,18,60,470
	Other Agency Projects	5,72,64,171	9,69,32,954	1,58,71,441	8,98,53,621	8,34,935	5,75,75,122	4,15,84,755	24,74,214	2,43,17,762	12,67,86,788	61,67,930	12,69,67,469
	Total Thiruvananthapuram Centre	44,30,42,352	32,73,72,389	3,28,94,764	9,17,13,621	3,08,30,525	17,33,15,849	9,44,99,717	1,65,72,368	22,28,23,882	53,80,42,341	2,81,52,846	32,88,27,939

Annexure 2 of Schedule 3 **Funded Projects**
(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

Sr.No.	Name of the Project	Opening Balance	Grants Received During the year	Interest Earned	Other Income & CDAC's Contribution During the year	Capital Expenditure	Salary, Wages Allowances etc.	Componants, Consumables and Other Direct Expenses	Travel	Contingencies, Overheads and Other Administrative Expenditure	Total Expenses	Refund / Transfer & Other Adjustments	Closing Balance
	Total DIT Projects	1,00,07,26,962	79,91,48,056	4,27,16,734	28,64,392	16,07,31,822	45,35,46,978	11,73,44,200	5,19,32,237	40,09,05,216	1,08,77,58,610	5,78,84,445	60,31,11,246
	Total Other Agency Projects	14,81,49,403	25,83,01,353	2,02,05,449	8,99,76,791	52,72,480	7,34,96,233	8,41,00,113	83,11,419	4,46,37,443	21,53,55,900	2,13,45,342	27,94,69,966
	Grand Total	1,14,88,76,365	1,05,74,49,409	6,29,22,183	9,28,41,183	16,60,04,302	52,70,43,211	20,14,44,313	6,02,43,656	44,55,42,659	1,30,31,14,510	7,92,29,787	88,25,81,212

Amount in ₹

Particulars	2012-2013	2011-2012
Schedule 4 - Current Liabilities and Provisions		
A. Current Liabilities		
1. Acceptances	-	-
2. Trade Payables (For Goods and Others)	26,17,96,966	21,12,57,820
3. Advances Received		
a) Advances Received from Parties	22,75,11,283	18,02,69,028
b) Fees Received in Advance	61,00,905	1,71,14,078
c) AMC Charges Received in Advance	-	-
d) Rent/Other Income Received in Advance	10,82,081	16,43,465
4. Statutory Liabilities		
a) Overdue	-	-
b) Others		
I) Members CPF Recovery Payable	68,03,853	39,30,992
ii) Members VPF Payable	7,57,714	3,37,178
iii) Members CPF Loan Recovery Payable	3,23,065	29,601
iv) Members Benevolent Fund Payable	2,55,745	5,195
v) Members CGEIS/Group Insurance Payable	2,90,496	95,234
vi) Members Other Recoveries Payable	41,37,560	49,04,974
vii) C-DAC's Contribution to Benevolent Fund Payable	49,824	1,430
viii) C-DAC's Contribution to CPF Payable	83,04,812	52,98,708
ix) Leave Salary and Pension Contribution Payable	7,65,84,683	10,03,89,703
x) Gratuity Payable	4,77,04,707	4,07,43,388
xi) Members Income Tax Payable	67,08,147	16,04,173
xii) Tax Deducted at Source Payable	72,43,362	1,14,84,857
xiii) Profession Tax Payable	2,55,350	59,835
xiv) General Sales Tax Payable	60,257	36,44,879
xv) Central Sales Tax Payable	2,48,351	32,32,951
xvi) Works Contract Tax Payable	-	-
xvii) Service Tax Payable	47,41,834	41,07,796
5. Other Current Liabilities		
a) Unpaid Salaries	3,28,01,498	3,50,71,736
b) Library/ Other Security Deposits Payable	1,83,84,602	1,30,30,717
c) Earnest Money Deposit Contractors Payable	1,25,52,735	1,18,10,623
d) Retention Deposit Contractors	1,60,78,876	1,66,23,831
e) Refund of Course Fees Due	18,70,368	7,52,214
f) Excess Lease Deposit Payable	16,550	51,550
g) ATC's & Others Share in Fees Payable/Other Current Liabilities	26,51,01,128	25,31,35,213
h) GIST/PACE Dealer's Deposit Payable	12,71,045	12,71,045
Total (A)	1,00,90,37,797	92,19,02,214
B. Provisions		
1. Others (Specify)		
a) Provisions / Accrued Liabilities for Expenses	4,17,08,014	3,83,51,876
Total (B)	4,17,08,014	3,83,51,876
Total (A)+(B)	**1,05,07,45,811**	**96,02,54,090**

Schedule-5 FIXED ASSETS Acquired out of own funds

(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

		Gross Block						Depreciation					Net Block	
Sr.No.	Particulars	Cost/Valuation as on beginning of the year	Additions During the Year			Deletion/Adjustments During the Year	Cost/Valuation as on end of the year	Depreciation as at beginning of the year	Depreciation Written Back	Depreciation Rate	Depreciation for Current Year	Total Depreciation up to the year end	WDV (Closing)	WDV (Opening)
			On or Before 30th September	After 30th September	Total Additions during the year									
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Land													
	a) Freehold	3,21,46,675	-	-	-	-	**3,21,46,675**	-	-	0%	-	-	**3,21,46,675**	**3,21,46,675**
	b) Leasehold	15,42,75,062	3,80,909	-	**3,80,909**	-	**15,46,55,971**	1,18,13,791	-	0%	3,76,569	**1,21,90,360**	**14,24,65,611**	**14,24,61,271**
2	Building													
	a) On Freehold Land	65,65,566	-	-	-	-	**65,65,566**	23,05,688	-	10%	4,25,988	**27,31,676**	**38,33,890**	**42,59,878**
	b) On Leasehold Land	12,92,94,368	-	1,42,656	**1,42,656**	-	**12,94,37,024**	6,24,64,548	-	10%	66,97,248	**6,91,61,796**	**6,02,75,228**	**6,68,29,820**
	c) Ownership Flats/Premises	3,84,72,032	-	-	-	-	**3,84,72,032**	2,48,71,079	-	10%	13,60,095	**2,62,31,174**	**1,22,40,858**	**1,36,00,953**
	d) Superstructures on Land not belonging to the entity	1,47,34,869	-	-	-	-	**1,47,34,869**	1,17,09,639	-	10%	3,02,523	**1,20,12,162**	**27,22,707**	**30,25,230**
3	Plant, Machinery and Equipments	6,09,48,144	17,594	1,93,392	**2,10,986**	-	**6,11,59,130**	4,74,08,416	-	15%	20,62,607	**4,94,71,023**	**1,16,88,107**	**1,35,39,728**
4	Vehicles	1,26,15,268	-	-	-	-	**1,26,15,268**	47,99,338	-	15%	11,72,389	**59,71,727**	**66,43,541**	**78,15,930**
5	Furniture & Fixtures	8,27,92,581	8,90,725	22,78,498	**31,69,223**	13,821	**8,59,47,983**	5,12,60,959	13,565	10%	34,70,059	**5,47,17,453**	**3,12,30,530**	**3,15,31,622**
6	Office Equipments	2,60,28,651	11,63,510	6,90,391	**18,53,901**	2,29,379	**2,76,53,173**	1,71,37,918	37,088	15%	15,82,853	**1,86,83,683**	**89,69,490**	**88,90,733**
7	Air Conditioning Equipments	3,14,52,951	2,96,706	3,92,281	**6,88,987**	-	**3,21,41,938**	2,31,26,115	-	15%	13,52,374	**2,44,78,489**	**76,63,449**	**83,26,836**
8	Computer Peripherals	26,32,84,506	74,96,091	84,89,011	**1,59,85,102**	21,14,368	**27,71,55,240**	25,40,52,875	19,33,641	60%	1,50,21,604	**26,71,40,838**	**1,00,14,402**	**92,31,631**
9	Electrical Installations	4,99,36,839	2,05,943	43,067	**2,49,010**	1,70,000	**5,00,15,849**	3,82,35,579	1,64,233	10%	11,94,450	**3,92,65,796**	**1,07,50,053**	**1,17,01,260**
10	Electronic Tools & Lab Equipments	69,30,298	40,932	63,944	**1,04,876**	-	**70,35,174**	34,94,330	-	15%	5,31,126	**40,25,456**	**30,09,718**	**34,35,968**
11	Library Books	1,31,84,734	1,18,885	4,31,777	**5,50,662**	-	**1,37,35,396**	1,27,93,762	-	60%	5,64,981	**1,33,58,743**	**3,76,653**	**3,90,972**
12	Copyright Know-how	66,950	-	-	-	-	**66,950**	55,148	-	25%	2,951	**58,099**	**8,851**	**11,802**
13	Other Fixed Assets	51,36,245	11,394	8,441	**19,835**	7,335	**51,48,745**	35,92,359	4,418	15%	2,34,121	**38,22,062**	**13,26,683**	**15,43,886**
	Total	**92,78,65,739**	**1,06,22,689**	**1,27,33,458**	**2,33,56,147**	**25,34,903**	**94,86,86,983**	**56,91,21,544**	**21,52,945**		**3,63,51,938**	**60,33,20,537**	**34,53,66,446**	**35,87,44,195**
	Capital Work-in-progress	43,80,981	5,51,410	-	5,51,410	36,93,175	**12,39,216**	-	-		-	-	12,39,216	43,80,981
	Grand Total	**93,22,46,720**	**1,11,74,099**	**1,27,33,458**	**2,39,07,557**	**62,28,078**	**94,99,26,199**	**56,91,21,544**	**21,52,945**		**3,63,51,938**	**60,33,20,537**	**34,66,05,662**	**36,31,25,176**
	Previous Year	1,01,80,84,232	84,84,345	4,40,21,529	**5,25,05,874**	13,83,43,386	**93,22,46,720**	53,88,37,877	71,43,011		3,74,26,678	**56,91,21,544**	**36,31,25,176**	**47,92,46,355**

Schedule-6 FIXED ASSETS Acquired out of Grant-In-Aid

(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

		Gross Block						Depreciation					Net Block	
Sr.No.	Particulars	Cost/Valuation as on beginning of the year	Additions During the Year			Deletion/Adjustments During the Year	Cost/Valuation as on end of the year	Depreciation as at beginning of the year	Depreciation Written Back	Depreciation Rate	Depreciation for Current Year	Total Depreciation up to the year end	WDV (Closing)	WDV (Opening)
			On or Before 30th September	After 30th September	Total Additions during the year									
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Land													
	a) Freehold	49,04,850	-	-	-	-	**49,04,850**	-	-	0%	-	-	**49,04,850**	**49,04,850**
	b) Leasehold	1,67,45,711	-	-	-	-	**1,67,45,711**	14,92,342	-	0%	1,71,770	**16,64,112**	**1,50,81,599**	**1,52,53,369**
2	Building													
	a) On Freehold Land	6,58,09,591	-	-	-	-	**6,58,09,591**	5,05,48,742	-	10%	15,26,085	**5,20,74,827**	**1,37,34,764**	**1,52,60,849**
	b) On Leasehold Land	11,46,07,489	-	10,14,231	**10,14,231**	-	**11,56,21,720**	7,89,92,953	-	10%	36,62,877	**8,26,55,830**	**3,29,65,890**	**3,56,14,536**
	c) Ownership Flats/Premises	33,41,269	-	-	-	-	**33,41,269**	25,72,256	-	10%	76,901	**26,49,157**	**6,92,112**	**7,69,013**
	d) Superstructures on Land not belonging to the entity	-	-	-	-	-	-	-	-	10%	-	-	-	-
3	Plant, Machinery and Equipments	7,21,93,499	10,54,984	28,98,065	**39,53,049**	-	**7,61,46,548**	5,98,90,783	-	15%	24,38,365	**6,23,29,148**	**1,38,17,400**	**1,23,02,716**
4	Vehicles	1,52,40,511	-	-	-	7,07,190	**1,45,33,321**	1,12,69,438	6,63,896	15%	5,89,166	**1,11,94,708**	**33,38,613**	**39,71,073**
5	Furniture & Fixtures	9,42,42,914	8,82,843	68,75,249	**77,58,092**	-	**10,20,01,006**	6,34,31,132	-	10%	38,56,988	**6,72,88,120**	**3,47,12,886**	**3,08,11,782**
6	Office Equipments	4,13,89,329	23,31,022	41,36,602	**64,67,624**	15,215	**4,78,41,738**	2,95,39,549	13,866	15%	27,47,407	**3,22,73,090**	**1,55,68,648**	**1,18,49,780**
7	Air Conditioning Equipments	4,72,38,680	3,36,768	4,77,664	**8,14,432**	-	**4,80,53,112**	3,45,43,133	-	15%	20,26,498	**3,65,69,631**	**1,14,83,481**	**1,26,95,547**
8	Computer Peripherals	90,67,99,518	3,69,14,266	17,08,97,086	**20,78,11,352**	5,529	**1,11,46,05,341**	86,82,14,102	-	60%	14,78,34,745	**1,01,60,48,847**	**9,85,56,494**	**3,85,85,416**
9	Electrical Installations	6,05,95,818	22,97,017	1,14,428	**24,11,445**	-	**6,30,07,263**	3,49,98,014	-	10%	28,00,925	**3,77,98,939**	**2,52,08,324**	**2,55,97,804**
10	Electronic Tools & Lab Equipments	8,01,36,669	6,43,273	46,50,620	**52,93,893**	-	**8,54,30,562**	6,36,08,969	-	15%	32,73,239	**6,68,82,208**	**1,85,48,354**	**1,65,27,700**
11	Library Books	3,83,61,478	3,86,769	88,754	**4,75,523**	2,765	**3,88,34,236**	3,76,46,001	2,759	60%	7,14,597	**3,83,57,839**	**4,76,397**	**7,15,477**
12	Copyright Know-how	4,40,660	-	-	-	-	**4,40,660**	4,40,510	-	25%	38	**4,40,548**	**112**	**150**
13	Other Fixed Assets	53,03,730	79,250	16,91,010	**17,70,260**	-	**70,73,990**	40,90,903	-	15%	4,47,463	**45,38,366**	**25,35,624**	**12,12,827**
	Total	**1,56,73,51,716**	**4,49,26,192**	**19,28,43,709**	**23,77,69,901**	**7,30,699**	**1,80,43,90,918**	**1,34,12,78,827**	**6,80,521**		**17,21,67,064**	**1,51,27,65,370**	**29,16,25,548**	**22,60,72,889**
	Capital Work-in-progress	91,63,28,218	1,50,85,264	4,66,19,196	6,17,04,460	-	**97,80,32,678**	-	-		-	-	97,80,32,678	91,63,28,218
	Grand Total	**2,48,36,79,934**	**6,00,11,456**	**23,94,62,905**	**29,94,74,361**	**7,30,699**	**2,78,24,23,596**	**1,34,12,78,827**	**6,80,521**		**17,21,67,064**	**1,51,27,65,370**	**1,26,96,58,226**	**1,14,24,01,107**
	Previous Year	2,06,17,17,852	3,33,87,597	39,17,06,419	**42,50,94,016**	31,31,934	**2,48,36,79,934**	1,26,26,58,960	30,02,458		8,16,22,325	**1,34,12,78,827**	**1,14,24,01,107**	**79,90,58,892**

Schedule-7 FIXED ASSETS Acquired out of Project Grants

(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

		Gross Block						Depreciation					Net Block	
Sr.No.	Name of the Project	Cost/Valuation as on beginning of the year	Additions During the Year			Deletion/Adjustments During the Year	Cost/Valuation as on end of the year	Depreciation as at beginning of the year	Depreciation Written Back	Depreciation Rate	Depreciation for Current Year	Total Depreciation up to the year end	WDV (Closing)	WDV (Opening)
			On or Before 30th September	After 30th September	Total Additions during the year									
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Bangalore Centre Project Assets	8,51,77,688	48,77,514	3,77,27,036	4,26,04,550	-	12,77,82,238	8,00,45,663	-		2,66,12,007	10,66,57,670	2,11,24,568	51,32,025
2	Chennai Centre Project Assets	4,40,86,432	4,23,962	44,07,130	48,31,092	-	4,89,17,524	2,81,76,799	-		57,91,291	3,39,68,090	1,49,49,434	1,59,09,633
3	Corporate Project Assets	-	-	-	-	-	-	-	-		-	-	-	-
4	Delhi Centre Project Assets	15,72,623	-	-	-	-	15,72,623	14,83,887	-		46,690	15,30,577	42,046	88,736
5	Hyderabad Centre Project Assets	5,94,59,370	2,92,00,068	-	2,92,00,068	-	8,86,59,438	5,19,25,814	-		2,13,03,998	7,32,29,812	1,54,29,626	75,33,556
6	Kolkata Centre Project Assets	-	-	-	-	-	-	-	-		-	-	-	-
7	Mohali Centre Project Assets	6,75,77,881	29,61,317	30,72,889	60,34,206	-	7,36,12,087	5,72,19,847	-		54,12,699	6,26,32,546	1,09,79,541	1,03,58,034
8	Mumbai Centre Project Assets	25,73,87,474	11,31,450	1,34,63,251	1,45,94,701	-	27,19,82,175	20,73,81,112	-		1,64,83,075	22,38,64,187	4,81,17,988	5,00,06,362
9	Noida Centre Project Assets	4,87,60,632	23,23,019	8,80,570	32,03,589	-	5,19,64,221	4,43,69,759	-		18,66,948	4,62,36,707	57,27,514	43,90,873
10	Pune Centre Project Assets	36,39,05,573	73,49,291	2,73,56,280	3,47,05,571	-	39,86,11,144	33,43,60,422	-		3,57,89,741	37,01,50,163	2,84,60,981	2,95,45,151
11	Thiruvananthapuram Centre Project Assets	18,04,14,909	1,64,83,413	1,43,47,112	3,08,30,525	2,90,000	21,09,55,434	10,70,23,981	1,74,000		2,24,49,883	12,92,99,864	8,16,55,570	7,33,90,928
	Total	1,10,83,42,582	6,47,50,034	10,12,54,268	16,60,04,302	2,90,000	1,27,40,56,884	91,19,87,284	1,74,000		13,57,56,332	1,04,75,69,616	22,64,87,268	19,63,55,298
	Capital Work-in-progress	-	-	-	-	-	-	-	-		-	-	-	-
	Grand Total	1,10,83,42,582	6,47,50,034	10,12,54,268	16,60,04,302	2,90,000	1,27,40,56,884	91,19,87,284	1,74,000		13,57,56,332	1,04,75,69,616	22,64,87,268	19,63,55,298
	Previous Year	1,00,54,55,676	2,87,76,201	7,42,30,519	10,30,06,720	1,19,814	1,10,83,42,582	80,95,41,269	1,19,618		10,25,65,633	91,19,87,284	19,63,55,298	19,59,14,407

Amount in ₹

Particulars	2012-2013	2011-2012

Schedule 8 - Current Assets, Loans and Advances Etc.

A. Current Assets		
1. Inventories :		
a) Stores and Spares	-	-
b) Loose Tools	-	-
c) Stock in trade		
Finished Goods	16,73,360	19,55,761
Work-in-progress	5,83,518	5,49,830
Raw Material	23,93,042	33,84,324
d) Stock of Course Material	9,15,754	7,34,621
2. Sundry Debtors		
Trade Receivables	42,14,64,604	50,37,81,203
Less: Provision for Bad and Doubtful Debts	14,05,93,453	14,59,95,533
	28,08,71,151	35,77,85,670
3. Cash balances in hand (including cheques/drafts and imprest)	66,448	11,79,226
4. Bank Balances		
a) With Scheduled Banks		
On Deposit Accounts (includes margin money)	3,84,35,84,611	3,62,28,64,608
On Savings/Current Account	59,51,85,790	38,73,39,287
b) Funds/Goods in Transit	85,68,439	3,87,878
5. Post Office-Savings Accounts	-	-
Total (A)	4,73,38,42,113	4,37,61,81,205
B. Loans, Advances and Other Assets		
1. Loans		
a) Staff	1,01,50,015	1,16,93,951
b) Other (Specify)	-	-
2. Advances and other amounts recoverable in cash or in kind or for value to be received		
a) On Capital Account	-	-
b) Prepayments (Advances to Suppliers)	2,40,04,237	3,58,75,700
c) To Employees	65,32,036	54,35,527
d) To Others	1,89,47,962	3,21,57,621
3. Income Accrued		
a) On Investments from Earmarked/Endowment Funds	-	-
b) On Bank Deposits	14,08,74,402	11,30,69,268
c) Others		
I) Course Fee Receivable	4,22,016	6,35,293
ii) Receivable from Guest House Receipts	-	-
iii) Other Grants Receivables	-	84,38,58,270
4. Claims Receivable		
a) Insurance Claims Lodged but not received	5,58,403	-
b) Cliams due but not received	6,25,354	6,25,354
c) Excise Duty paid under Protest	-	-
d) Income Tax Deducted at Source	7,21,97,477	5,74,49,062
e) Sales Tax Paid Under Protest	-	-
f) Sales Tax Refund Due	2,61,290	2,61,290
g) Receivable from PF Trust	5,838	1,314
h) Other Receivables	72,35,794	91,62,497
5. Prepaid Expenses		
a) Insurance	17,16,984	14,01,455
b) Other Expenses	81,12,491	82,08,443

Amount in ₹

Particulars	2012-2013	2011-2012
6. Deposits (Assets)		
a) Telephone Deposit	11,94,433	12,05,704
b) Lease Rent Deposit	4,17,56,950	3,90,67,756
c) Other Deposits	2,30,74,893	2,27,68,649
d) Security Deposit	5,27,84,873	4,73,08,526
e) Excise PLA Deposit	10,91,405	1,71,397
f) Excise Under D3 and 57F3	-	-
g) Tender Deposit	69,86,945	96,99,945
7. Differed Expenses		
a) Unutilised Modvat / Cenvat	61,16,908	7,28,900
b) Differed Expenses on Projects	-	-
Total (B)	42,46,50,706	1,24,07,85,922
Total (A+B)	**5,15,84,92,819**	**5,61,69,67,127**

Schedule 9 - Income from Sales/Services

1. Income from Sales		
a) Sale of Finished Goods	13,11,32,310	28,27,79,416
b) Sale of Raw Material	-	-
c) Sale of Scraps	55,425	1,59,374
2. Income from Services		
a) Software Development Charges	2,83,13,690	3,02,46,312
b) Others (Specify)		
AMC Charges Received	4,01,93,227	2,40,40,736
Consultancy Charges / Service Charges	21,49,53,681	25,49,10,233
Networking Charges	-	-
3. Inter Unit / Inter Branch Sales / (Purchases)	-	-
Total	**41,46,48,333**	**59,21,36,071**

Schedule 10 - Grants/Subsdies

(Irrevocable Grants & Subsdies Received)

1. Central Government	97,91,00,000	86,52,00,000
2. Others (Specify)		
a) C-DAC's own Contribution and Other Adjustments	-	-
3. Less : Amount utilised for Capital Expenditure in the current year transferred to Capital Reserve	6,22,14,494	3,92,45,916
Total	**91,68,85,506**	**82,59,54,084**

Schedule 11 - Fees/Subscriptions

(Accounting Policies towards each item are to be disclosed)

1. Entrance Fees	29,100	4,17,951
2. Course Fees	50,44,96,818	52,28,53,793
3. Annual Fees/Subscriptions	2,82,92,974	3,09,00,802
4. Authorization Fees	27,79,993	23,00,000
5. Others (Specify)		
a) Virtual Centre Processing Fees	20,000	93,000
b) Admission Cancellation Fees	23,33,045	14,20,000
c) Examination Fees	1,45,30,127	65,63,087
d) Late Fee	1,11,736	3,00,247
e) Registration Fees / Project Fee	16,53,737	19,21,445
f) Students Hostel Fees	93,31,476	88,41,698
TOTAL	**56,35,79,006**	**57,56,12,023**

Amount in ₹

Particulars	2012-2013	2011-2012
Schedule 12 - Income From Investments		
Income on Investment from Earmarked/Endowment Funds transferred to Funds)		
Interest		
1. On Term Deposits		
a) With Scheduled Banks	3,93,12,507	72,29,070
2. On Savings Accounts		
a) With Scheduled Banks	60,80,566	1,04,00,003
3. On Loans		
a) Employees/Staff	25,666	5,43,194
Total	4,54,18,739	1,81,72,267
Transferred to Earmarked/Endowment Funds	4,54,18,739	1,81,72,267
Net Balance	-	-
Schedule 13 - Interest Received		
1. On Term Deposits		
a) With Scheduled Banks	20,30,24,825	16,55,50,954
2. On Savings Accounts		
a) With Scheduled Banks	43,47,833	40,28,740
3. On Loans		
a) Employees/Staff	8,17,155	4,69,967
Total	**20,81,89,813**	**17,00,49,661**
Schedule 14 - Other Income		
1. Profit on Sale/Disposal of Assets		
a) Owned Assets	3,51,287	27,022
b) Assets acquired out of grants, or received free of cost	2,45,746	1,17,491
2. Exports Incentives Realized	-	1,40,560
3. Fees for Miscellaneous Services	80,38,421	1,01,68,838
4. Miscellaneous Income	1,27,25,621	1,23,04,565
Total	**2,13,61,075**	**2,27,58,476**
Schedule 15 - Increase/(Decrease) In Stock of Finished Goods & Work-In-Progress		
a) Closing Stock		
Finished Goods	16,73,360	19,55,762
Work-in-progress	5,83,518	5,49,830
Raw Material	23,93,042	33,84,324
Loose Tools	-	-
Course Material Stock	9,15,754	7,34,621
b) Less : Opening Stock		
Finished Goods	19,55,762	2,36,83,822
Work-in-progress	5,49,830	16,25,944
Raw Material	33,84,324	39,86,938
Loose Tools	-	-
Course Material Stock	7,34,621	5,86,713
Total (a-b)	**(10,58,863)**	**(2,32,58,880)**

Amount in ₹

Particulars	2012-2013	2011-2012
Schedule 16 - Establishment Expenses		
a) Salaries & Wages	67,16,94,308	55,66,26,731
b) Allowances & Bonus		-
Awards & Prizes	3,07,450	13,86,530
Bonus	21,22,761	12,87,436
Canteen Facility	1,23,78,341	1,28,07,424
Hire Charges - Contractual Services	4,09,19,834	3,58,97,176
Lease Rent for Employees Quarters	3,58,51,913	3,97,01,370
Leave Travel Concession	94,82,748	19,25,100
Medical Reimbursement	4,02,46,809	2,61,30,754
Members Medical & Accident Insurance Expenses	16,51,360	23,69,662
Misc. Allowances and Other Reimbursements	89,58,761	81,45,223
Reimbursement of Conveyance Expenses	4,55,653	7,67,542
Staff Recruitment Expenses	50,69,569	38,69,009
Staff Training Expenses	14,97,995	21,36,054
Transfer & Relocation Expenses	3,84,698	1,59,495
c) Contribution to Provident Fund	5,34,07,873	5,90,28,562
d) Contribution to Other Funds (Benevolent Fund)	-	68,347
e) Staff Welfare Expenses	94,59,536	70,91,548
f) Expenses on Employees Retirement and Terminal Benefits		-
Gratuity	3,39,38,386	3,50,29,674
Leave Encashment	1,93,20,745	4,11,89,585
Leave Salary & Pension Contribution	1,25,46,145	82,81,619
g) Others (Specify)	19,94,361	10,61,114
Total	**96,16,89,246**	**84,49,59,955**
Schedule 17 - Other Administrative Expenses Etc.		
a) Purchases	5,11,98,845	4,41,44,703
b) Direct Expenses		
Consumables	1,11,60,938	1,25,35,724
Design and Development Charges	-	-
Excise/Custom Duty/Service Tax Paid	47,60,129	25,89,082
Freight and Handling Expenses	2,59,219	6,17,853
Labour Charges	2,78,219	29,56,730
Liquidated Damages	36,477	99,270
Material Insurance Expenses	-	52,668
Octroi	1,11,196	1,85,981
Other Packing Charges	45,615	-
Royalty and Support Fees	11,498	8,500
Software Development Consultancy Charges	1,82,16,825	1,05,78,546
Technical Service Charges	50,77,450	97,58,659
Warehouse Charges	-	-
c) Expenses on Courses		
Advertisement Expenses	1,24,20,614	70,81,977
ATC's Share in Fees	12,97,28,838	16,02,54,375
Awards & Prizes	-	2,44,000
Campus Interview Expenses	13,65,729	10,25,170
Course Material Production Expenses	2,24,09,100	2,24,11,750
Data Entry & Scanning Expenses	4,47,357	-
Examination Expenses	76,49,981	2,78,21,156
Faculty Members Expenses	2,80,46,600	2,63,86,192
Other Course Related Expenses	2,20,12,940	5,20,33,156
Printing of Forms & Prospectus	2,19,909	1,29,571
Students Hostel Expenses	9,13,451	4,70,591

Amount in ₹

Particulars	2012-2013	2011-2012
d) Administrative Expenses		
Administrative Charges on Provident Fund	25,31,004	26,49,817
Asset Hire Charges	10,32,904	5,95,046
Auditors Remuneration	9,91,509	7,28,446
Bank Charges and Commission	17,34,979	12,88,029
C-DAC's Contribution to Funded Projects	16,56,692	95,05,381
Cultural Program Expenses	30,48,098	26,72,755
Development Contracts and Spon. Project Expenses	10,45,642	63,27,185
Electricity, Power and Water Charges	3,85,59,115	6,12,27,275
Entertainment/Hospitality Expenses	18,39,512	27,38,381
Foreign Exchange Fluctuation	1,06,614	(7,97,270)
Gifts and Presentation	22,82,621	14,66,430
Insurance	12,26,828	9,82,970
Interest Paid	8,53,392	7,06,155
Irrecoverable Balances Written-off/(Written-back)	1,73,287	(37,82,265)
Legal & Professional Charges	1,10,72,545	87,34,925
Miscellaneous Expenses	57,39,373	11,96,227
Office Expenses	1,04,13,640	59,95,064
Postage, Telephone & Communication Charges	1,53,04,091	2,09,16,530
Printing and Stationery	76,32,110	94,18,198
Provision for Bad and Doubtful Debts/Advances	(27,73,526)	49,73,488
Rent, Rates and Taxes	6,66,02,106	7,20,27,912
Sales Tax	21,90,902	31,22,605
Service Hire Charges	3,18,87,133	3,12,52,824
Subscription of Periodicals & Newspapers	20,82,393	20,61,945
Tender Expenses	69,758	1,35,509
Training Expenses	7,17,167	11,88,462
Transit Quarter & Guest House Expenses	34,95,338	31,19,556
Transportation Charges	3,32,839	8,33,204
Vehicles Hire, Running and Maintenance	83,30,169	1,11,28,472
e) Repairs and Maintenance		
Air Conditioning Equipments	33,10,621	29,01,925
Building	43,99,573	37,25,545
Computers	68,91,821	51,13,639
Electrical Fittings	92,42,404	77,42,612
Furniture and Fixtures	12,21,297	13,71,313
Garden Maintenance	6,22,956	3,25,659
Lab Equipments	4,65,524	14,45,167
Office Equipments	21,12,322	11,26,755
Other Assets	7,25,005	17,86,852
f) Travelling and Conveyance Expenses		
Inland Travel Expenses		
Director	33,85,016	28,57,835
Members	2,40,63,369	2,72,26,375
Others	15,41,266	6,66,064
Foreign Travel Expenses		
Director	10,79,103	1,97,666
Members	83,41,800	44,18,706
Others	2,45,563	-
Conveyance Expenses	-	18,31,775
g) Selling Distribution and Business Promotion Expenses		
Advertisement Expenses	16,54,162	23,41,655
Expenses on Exhibition, Seminars/Workshops	1,21,08,174	64,78,354
Distribution Expenses	20,89,714	48,78,053
Product Literature & Brochures Expenses	1,01,644	91,857
Other Sales Promotion Expenses	-	3,85,303
h) Corporate Office Expenses	-	-
i) Other Expenses	2,21,386	14,08,584
Total Other Administrative Expenses	62,03,71,885	72,21,20,604

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING
Significant Accounting Policies and Notes to The Accounts for the year 2012-13

Schedule 18: Significant Accounting Policies:

1. Accounting Convention

The financial statements are prepared under the historical cost convention C-DAC follows Mercantile System of Accounting and recognizes Income and Expenditure on Accrual basis except otherwise stated, and the following items, due to their peculiar nature are recognized otherwise:

1.1. The course fees of Diploma in Advanced Computing and other Courses commencing before the end of financial year and the duration of which falls beyond the financial year are recognized entirely in the year under audit. In respect of these courses, entire expenditure of course material and agreed proportionate share of the Authorized Training Centers (ATCs) is also accounted for in the year under audit.

1.2. Bonus is accounted for on Cash Basis.

1.3. Expenditure incurred on incomplete Software Development Projects is expensed out in the year of incurrence.

2. Revenue Recognition

2.1. Sales are recognized as net of Trade Discount, Sales Returns and Excise Duty, but including Central Sales Tax & Vat.

2.2. Software Development Charges are recognized on the basis of Terms of Individual Contract and / or as per Phases of completion.

2.3. The income in respect of Annual Maintenance Contract is recognized on accrual basis and as per the terms of individual contracts entered into with parties.

2.4. Income in respect of consultancy charges/service charges is recognized on accrual basis and on the basis of terms of individual contracts entered into with the parties.

2.5. Grants in aid received from the government are treated as income to the extent of net of capital expenditure incurred during the year.

2.6. Interest and other miscellaneous incomes are accounted for on accrual basis.

3. Fixed Assets

3.1 Actual cost of fixed assets acquired is accounted for as per the terms of purchase order; any recovery is netted off to the cost of the asset and all expenses directly attributable to the acquisition and installation of the fixed assets are capitalized.

3.2 Fixed Assets are stated at Cost less Accumulated Depreciation.

3.3 Direct Material Cost with respect to major Fixed Assets developed in-house is capitalized along with manpower and Overhead costs. The Manpower and Overhead costs are charged on basis of man-days spent on the development of Assets as ascertained by the Management. Cost of prototype incurred in the process is charged to Revenue.

3.4 Costs incurred on Assets, which are in process of acquisition, or installation or development is treated as Capital WIP.

3.5 Fixed Assets created out of Sponsored Project Grants and lying at project site are not capitalized and shown as consumables under revenue expenditure.

4. Depreciation

4.1. The ownership of assets acquired out of Mission Grants & Sponsored Projects Grants rests with the respective funding agencies. However, depreciation is charged on the WDV basis on all assets including on those acquired out of Mission and Sponsored Project Grants. The Written-Down Value of the said assets is represented by an equivalent amount of Capital Reserve.

4.2. All additions to Fixed Assets are fully depreciated irrespective of the date of acquisition. Depreciation is charged at the rates prescribed by Income Tax Act 1961.

5. Inventory Valuation

The inventories are valued and certified by the Management as under –

5.1. Components, Raw Materials and Loose Tools in stock are valued at cost or net realizable value which ever is lower.

5.2. Work in Progress and Finished Goods are valued at cost.

5.3. Course Material stock is valued at landed cost. The course material, which is outdated due to change in the syllabus, is shown at nil value.

6. Deferred Expenditure on Projects

The expenditure incurred on incomplete business projects for which income is to be recognized in the ensuing period is deferred.

7. Foreign Currency Transaction

7.1. Transactions denominated in foreign currency are accounted at the exchange rate prevailing on the date of transaction and difference between the date of transaction and payment/receipt are accounted for as income or expenditure as the case may be.

7.2. Current assets and current liabilities denominated in foreign currency are converted at the exchange rate prevailing as at the year-end and the resultant gain/loss is adjusted to revenue account. Contingent liabilities denominated in foreign currency are converted at the exchange rate prevailing as at the year-end.

8. Retirement Benefits

Retirement benefits in respect of Provident Fund, Pension Fund, Gratuity and Leave Encashment has been provided for on accrual basis.

9. Other Policies

All other Accounting Policies are generally consistent with normally accepted accounting practices.

CA Raghu Bhargava
Director (Finance)

R.Y. Deshpande
Registrar

Prof. Rajat Moona
Director General

For **M/S Patil Ranadive & Associates**
Chartered Accountants
FR no. 107816W

Janardan Ranadive
Partner
M.No. 032953

Date: **24th September 2013**
Place: Pune

Schedule 19: Notes to Accounts

1. **Merger of Societies with C-DAC**

The Assets, Liabilities and Other obligations at the book value as on December 15, 2002 are merged in C-DAC in respect of the societies viz. Electronics Research And Development Centre at Kolkata, Noida, Thiruvananthapuram, National Centre for Software Technology Mumbai, and Centre For Electronics Design And Technology of India, Mohali, due to merger of these Societies in C-DAC as per the Government of India orders.

However the process for transfer of title deeds of Immovable property of the above centre is under process. The Management of C-DAC is of the opinion that there will be no liability on transfer of assets for stamp duty, taxes and other expenses and hence the same is not provided for in the books. However liability if any will be accounted for in the year of payment.

2. **Capital Commitment**

Capital Commitments outstanding ₹ 164.19 Lacs not provided for. (Previous year ₹ 358.42 Lacs)

3. **Sponsored Projects**

The Funded Projects show the unspent balance of ₹ 10434.66 Lacs and amount receivable from the granting authorities of ₹ 1608.87 Lacs.

4. **Contingent Liabilities**

4.1. Against Bank Guarantees: ₹ 1109.58 Lacs. (Previous year ₹ 735.67 Lacs)

4.2. Against Letter of Credit ₹ 116.60 Lacs. (Previous year ₹ 17.97 Lacs)

4.3. Against Service Tax : ₹ 313.10 Lacs (Previous year ₹ 313.10 Lacs)

4.4. Against Sales Tax : ₹ 21.64 Lacs (Previous year ₹ NIL)

4.5. Sales Tax Assessments are completed up to financial year 2004-.05 for Delhi and Pune, up to 2006-07 for Noida, up to 2008-09 for Bangalore, and up to 2011-12 for Mohali and Thiruvananthapuram. Chennai, Hyderabad and Kolkata are not covered by VAT/Sales Tax.

4.6. Against pending legal cases ₹ 61.86 Lacs. (Previous year ₹ 70.65 Lacs)

4.7. Income Tax exemption certificate u/s 35(1)(ii) for the period from 1st April 2004 to 31st March 2009 is under consideration at CBDT New Delhi duly recommended by CCIT Pune. Due to non issue of the Exemption Certificate by CBDT New Delhi, the assessing officer has passed an order imposing the tax & interest of Rs 1907.08 lacs . The appeal is filed & the demand is stayed by the assessing officer. therefore no liability is provided in the books of accounts.

4.8. Promotion case of Ms. Veena Tyagi is pending in Bombay High Court and Liability is not known.

5. **Statutory Liabilities**

5.1. The entire income of C-DAC is exempt u/s 10(21) being a scientific research association u/s 35(1)(ii) of the Income Tax Act, 1961, Hence no provision for income tax has been made.

5.2. The Management of C-DAC is of the opinion that C-DAC is exempt from payment of Contribution u/s 58 and Rule 32 of the Bombay Public Trust Act, 1959. Consequently, no provision has been made in books of account.

6 **Foreign Currency Transactions**

6.1 **Imports:** Total Rupee value of imports (CIF) during the year is as follows: (₹ in lacs)

Centre	Raw Material / Components	Capital Goods	Total
Current Year	386.81	1523.94	1910.75
Previous Year	525.18	361.90	887.08

6.2 **Expenditure in foreign currency for Travel:** ₹ 99.20 Lacs. (Previous Year ₹ 88.23 Lacs.)

6.3 **Other Expenditure in foreign currency**: ₹ 43.15 Lacs (Previous Year ₹ 17.62 Lacs.)

6.4 **Earnings in Foreign Exchange:** Total Earnings in Foreign Exchange during the year are as follows.

Currency	Current Year	Previous Year
US Dollars	278636.00	132661.00
GB Pounds	0.00	0.00
UAE Derham	0.00	0.00
Euro	92789.04	24994.79
Total Value in ₹ (In Lacs)	214.50	79.92

7 Remuneration to Statutary Auditors (for Branch Auditor)

For Statutory Audit	₹ 5.46 Lacs. (Previous year ₹ 2.87 lacs)
For Other Services Including Tax audit	₹ 0.66 Lacs (Previous year ₹ 0.46 Lacs)
Out of Pocket Expenses	₹ 0.33 Lacs (Previous year ₹ 0.37 Lacs)

8 Accounting of grants is made on accrual basis as per policy instead of receipt basis. The Grants (net off capital expenditure) & expenditure related to grants is routed trough Income &Expenditure account .

9 Interest received on grants is credited to the grant Account and not treated as revenue income. Expenses on the sponsored projects are also charged to respective grant account and not routed through Income & Expenditure Account.

10 Fixed Assets

The depreciation on the assets purchased out of grants is debited to Capital Reserve.

11 Current Assets and Current Liabilities

a. Balances of Debtors, Creditors, Receivables and Payables are subject to adjustments, writing off and confirmation and reconciliation from parties.

b. The amount outstanding for more than three years has been provided for as Bad and Doubtful Debts except the amount realized till date & the amount realizable from the existing customers . In the opinion of Management the said provision is adequate.

Age wise Analysis of Sundry Debtors is as follows:

₹ *In Lacs*

Centre	Less than 6 months	More Than 6 months	More Than 1 year	More Than 2 years	More Than 3 years	Total
Bangalore	0.00	0.00	1.40	7.55	240.21	249.16
Chennai	23.66	0.00	0.00	0.00	0.00	23.66
Delhi	35.52	22.24	132.01	0.00	131.34	321.11
Hyderabad	4.66	0.00	0.00	0.00	0.00	4.66
Kolkata	22.47	0.00	0.00	0.00	5.00	27.47
Mohali	224.76	91.54	14.63	35.94	0.00	366.87
Mumbai	194.09	0.00	32.35	14.82	0.48	241.74
Noida	324.13	40.01	475.93	175.03	295.35	1310.45
Pune	198.78	39.56	145.51	62.70	878.46	1325.01
Thiruvananthpuram	230.70	11.00	18.83	15.04	68.81	344.38
Total	1258.77	204.35	820.66	311.08	1619.65	4214.51
Previous Year	2086.50	400.34	740.90	177.64	1632.43	5037.81

12. Physical Verification

Physical verification of Fixed Assets/ stores has been carried out during the year. Reconciliation of some of the centers is in progress.

13. Internal Audit / Internal Control Systems

The centre has an internal control system, which is commensurate with the size and financial transactions of C-DAC. Internal audit is being conducted by external auditors during the year.

14. Lease Obligations AS19

Lease rent of ₹ 1314.97 Lacs for various premises are debited in the various heads of Income & Expenditure Account for the period under audit.

15. Other Discloser Requirements

The Management of C-DAC is of the opinion that C-DAC being a scientific society and not a commercial, industrial or a business entity the reporting requirements as per, Accounting Standard 3 on Cash flow statement, Accounting Standard 14 on Accounting for Amalgamations, Accounting Standard 17 on Segment Reporting, Accounting Standard 18 on Related Party Disclosure, Accounting Standard 26 in respect of Intangible Assets and Accounting Standard 29 in respect of Provisions, Contingent Liabilities & Contingent Assets, are not applicable.

16. The provisions of Gratuity and Leave Encashment are made on the basis of actuarial valuation & as per the provisions of AS 15 except as otherwise stated in the centre related notes .

17. Advances paid to employees include ₹ 0.87 Lacs as advances paid to directors.

18. Centre Specific Notes

18.1 Bangalore Centre

C-DAC, Electronic City, Bangalore unit merged with C-DAC, Knowledge Park, Bangalore centre on 30.10.2012 (As per Office Order No. 19/12 dt. 30.10.2012). All project assets and other assets procured on or before 31.10.2012 for C-DAC, electronic City Unit has been shown under C-DAC, Mumbai books of accounts and Depreciation for the same has been provided at C-DAC, Mumbai.

18.2 Delhi Centre

18.2.1 Adhoc provision was made for purchases for ₹2.00 lacs during the F.Y. 2006-07 in the absence of bill received from vendor. The final bill from vendor has not been received till date.

18.2.2 Income Tax deducted at source by customers relating to years up to 2007-08 amounting to ₹1.94 lacs is pending on account of non-receipt of certificate/non refund by Income Tax department. However no provision has been made towards this.

18.2.3 Sales Tax returns have not been filed since 2005-06 and the VAT No. and CST No. has been cancelled but new RCN has been taken during the current F.Y. 2012-13.

18.3 Hyderabad Centre

No provision is made towards Service Tax of ₹ 27.55 lacs and penalty of ₹ 13.02 lacs & Rs 100 per day as per the orders of Joint Commissioner Central Excise (Service Tax) for the year for 2004-05 to 2005-06. Similarly no provision is made against the show cause Notice issued by the Joint Commissioner Central Excise (Service Tax) for the year 2006-07 to 2009-10 for Rs 67.78 lacs & penalty of Rs 13.70 lacs. Appeals against above disputes are pending with various authorities.

18.4 Kolkata Centre

Fixed Assets amounting to ₹ 15.05 lacs (W. D.V. as on 31.03.2013 ₹ 0.23 lacs included in the Fixed Assets – Schedule – 7) has been transferred in the earlier year to SAMEER, Kolkata under DeitY, Govt. of India on loan basis.

18.5 Mohali Centre

Provision for an amount of ₹ 78.00 lacs (approx.) as show cause notice issued by Service Tax Department, Chandigarh is not paid as the reply has been sent .

18.6 Mumbai Centre

18.6.1 Unspent balance of ₹ 163.95 Lacs in the DGF – R&T project (DGF Project Ph. II) as on 31.03.2013 is grouped under Sundry Creditors. This unspent amount is to be utilized for the evaluation of the product developed under the project and for the future activities related thereto.

18.6.2 No liability is provided for an amount of ₹ 2799 Lacs. (₹ 1191 Lacs license fees & ₹ 1608 Lacs Interest) Claimed by Air India for payment of enhanced license fee for 8th Floor, of Air India Bldg, Nariman Point, Mumbai for the period April 1995 to Feb 2013 as per orders of the arbitrator as the appeal is filled before the competent authority.

18.6.3 The retirement benefits relating to CPF & GPF are as per Notification dated March 22, 1990 published in the Gazette of India, the employees of the Centre (formerly NCST) are governed by the provisions of the Provident Funds Act, 1925. The provision for LE & Gratuity is made on the basis of actuarial valuation. The Provision for Pension is made short by Rs 55.85 lacs as per valuation report.

18.6.4 As per the policy followed by the Centre since inception, subscriptions for Journals (Periodicals) have been capitalized and added with Library Books.

18.6.5 Conveyance Deed for the office and residential buildings in Mumbai have not been executed by the Bombay Housing & Area Development Board (BH&ADB), though the Centre has made the payment towards the acquisition of the said assets. The possession for the office building and the residential buildings has been obtained from BH&ADB from April 1, 1986 and June 1, 1986, respectively.

18.7 Noida Centre

18.7.1 Cabling of 128932 meters was done with a cost of ₹ 235.14 lacs at PGIMER Chandigarh and CDAC has billed ₹ 316.18 lacs inclusive Taxes. PGIMER has confirmed ₹ 22.00 lacs plus Taxes as quoted in the Tender. The balance amount of ₹ 291.98 lacs approx is disputed by PGIMER. For which no provision is made.

18.7.2 In House ERP Development Project was started during the financial year 2008-09. WIP Assets of ₹ 36.93 lacs was created during the F.Y. 2009-10. Now CDAC has switch over to IHRMS, therefore the assets has been written back.

18.7.3 Land has been acquired at plot No. C-56/1 and B-30, Sector – 62 Noida on 90 years lease from Noida Authority. Cost of the land has been amortized constantly from F.Y. 2008-09. ₹ 3.77 lacs has been amortized during the year and shown under the depreciation and ₹ 1.59 lacs has been amortized and shown under the head of Capital reserve.

18.8 Pune Centre

18.8.1 Activities of ACTS, Pune are shifted from Bio-Informatics Building, Pune University Campus to the premises located at 12 Thube Park, Shivajinagar, Pune 5, in the year 2004-2005. Some of the fixed assets of ACTS, Pune could not be shifted to this premises. Written down value of these assets as on 31st March 2013 is ₹ 9.24 Lacs.

18.8.2 Activities of C-DAC, Pune are shifted from 12 Thube Park, Shivajinagar, Pune 5 to the premises located at NSG-IT Park, Aundh, Pune, in the year 2008-2009. Some of the fixed assets of C-DAC, Pune could not be shifted to this premises. Written down value of these assets, as on 31st March 2013 is ₹ 51.59 Lacs.

18.8.3 "Memorandum of Understanding" (MOU) or "Leave and License Agreement", as the case may be, entered into with University of Pune and Small Industries Development Institute (SIDI) & employees regarding transfer of rights to use and develop immovable properties viz. Main Building, NPSF Building, NMRC Building and assets therein respectively are not registered. Lease agreements for accommodations hired for staff are not registered since most of the cases lease agreements are for the period of 12 months.

18.8.4 The Lease period of Vishrantwadi land has not been extended.

18.8.5 CDAC is holding the funds belonging to CDAC Employees Benevolent Fund and CDAC Members Welfare Fund. C-DAC has not contributed any amount to Benevolent Fund due to change in Staff Rules. Separate investments for the funds of Employees Benevolent Fund are maintained till August 2012; however, the funds of Members Welfare Fund and employees contribution to Benevolent Fund from November 2012 are not separately invested up to the date of Balance Sheet.

18.8.6 Advances of ₹26.82 lacs is pending against various claims of employees, will be booked during the financial year 2013-14. Since most of the claims will directly be debited to the Projects / Grants no provision is made and Surplus will not be affected.

18.9 Thiruvananthapuram Centre

18.9.1 Advances include the amount paid to M/s. Eworkz, Los Angels, USA, ₹ 25.41 lacs for the supply and installation of a LCD based video wall system at police control room Kochi. Centre has taken action to recover the advance through legal recourse.

18.9.2 Payment of ₹ 378.45 lacs for Group Leave Encashment policy against the liability till 31st March 2013 of ₹ 479.90 lacs is made.

18.9.3 In the absence of lease deed of land allotted by Govt. of Kerala, no lease rent is provided in the books of accounts.

19. Current year figures obtained from audited financial statements of centres are regrouped wherever necessary in preparation of consolidated financial statements. Previous years figures are regrouped, rearranged and reclassified wherever necessary.

20. Figures in the Financial Statements are rounded off to nearest rupee.

CA Raghu Bhargava
Director (Finance)

R.Y. Deshpande
Registrar

Prof. Rajat Moona
Director General

For **M/S Patil Ranadive & Associates**
Chartered Accountants
FR no. 107816W

Janardan Ranadive
Partner
M.No. 032953

Date: 24th September 2013
Place: Pune

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CDAC

Receipt and Payments for the year ended 31st March 2013

Amount in ₹ *Amount in ₹*

Receipts	2012-2013	2011-2012	Payments	2012-2013	2011-2012
I. Opening Balance			**I. Expenses**		
a) Cash on hand	11,79,226	2,48,269	a) Establishment Expenses	77,91,79,201	76,58,30,918
b) Bank Balances			b) Administrative Expenses	72,87,04,744	26,19,14,668
i) In Savings/Current Accounts	38,73,39,287	26,54,90,502	c) Payment made to Creditors for Goods and Others	1,48,94,75,486	1,47,35,17,977
II. Grants Received			**II. Payments made against funds for various projects**	14,03,91,889	14,81,23,647
			(Name of the Fund or Project along with the particulars of		
a) From Government of India	74,63,00,000	1,02,41,75,302	payment made for each project shown in separate schedule)		
b) From State Government	3,73,14,509	7,99,675			
b) Grant and Other Income Received					
for Projects	1,70,81,20,959	1,52,87,98,537	**III. Investments and Deposits made**	9,48,44,82,980	5,45,82,53,889
			IV. Expenditure on Fixed Assets and Capital Work in		
III. Income from Encashment of FDRs	9,23,80,65,757	4,83,62,21,492	**Progress**		
IV. Interest Received			a) Purchase of Fixed Assets	1,85,35,162	5,51,97,306
a) On Bank Deposits	21,41,88,321	11,16,15,736	b) Expenditure on Capital Work in Progress	-	-
b) Loans and Advances	2,45,61,119	6,55,142	**V. Refund of Surplus money/loans**	4,94,97,526	4,99,67,994
V. Other Income (Specify)			**VI. Finance Charges (Interest)**	2,25,068	-
a) Previous years Income recovered	1,85,47,155	7,06,94,727	**VII. Other Payments (Specify)**	-	-
b) Advances Received from Customers	4,89,44,191	23,94,43,930	a) Deposit (Assets)	1,93,02,226	14,74,89,794
d) Fees/Subscription & Direct Income	49,33,92,371	59,94,33,959	b) Loans and Advances	9,40,99,090	15,23,69,962
e) Other Income	12,41,06,113	5,75,07,887	c) Previous years outstanding payments	15,55,91,135	10,12,42,031
f) Amount Received from Debtors	42,48,29,017	59,44,76,846	d) Prepaid Expenses	39,76,704	42,93,325
g) Loans and Advances Recovered	3,10,48,814	14,72,37,869	e) Branch and Divisions	1,05,71,32,050	1,34,03,75,164
VI. Amount Borrowed			f) Deposits (Liabilities) Refunded	14,90,23,740	67,54,03,902
Branch and Divisions	1,15,00,64,255	1,38,52,15,975	**VIII. Closing Balance**		
Bank Loan	3,00,00,000	7,98,00,000			
VII. Any Other Receipt (Give Details)			a) Cash on hand	66,448	11,79,226
a) Deposits (Liabilities)	8,68,68,145	8,06,83,242	b) Bank Balances		
b) Addition to Reserve Fund	-	-	i) In Savings Accounts	59,51,85,790	38,73,39,287
Total	**14,76,48,69,239**	**11,02,24,99,090**	**Total**	**14,76,48,69,239**	**11,02,24,99,090**

AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
FOR PATIL RANADIVE & ASSOCIATES (FR NO. 107816W)
CHARTERED ACCOUNTANTS

CA Raghu Bhargava
Director (Finance)
Pune

R.Y. Deshpande
Registrar

Prof. Rajat Moona
Director General

Janardan Ranadive
Partner (Membership Number 032953)
Date: 24-Sep-2013

Shri Kapil Sibal, Hon'ble Minister of Communications and IT, Govt. of India was the chief guest and delivered the inaugural address at C-DAC Technology Conclave held during Feb 11-12, 2013 at New Delhi. Also present on the occasion were Shri J. Satyanarayana, Secretary, DeitY, GoI, Dr R Chidambaram, Principal Scientific Adviser to Govt. of India, Dr. Vijay P. Bhatkar, Chairman, Board of Governors, IIT Delhi, Prof. Rajat Moona, DG, C-DAC and Dr. B.K. Murthy, ED, C-DAC, Noida.

Shri J. Satyanarayana, Secretary, DeitY, GoI, launched PARAM Yuva - II, the new 500 TeraFlop version of its earlier PARAM Yuva at C-DAC, Pune on February 8, 2013. Seen in the Pic (R-L): Prof. Rajat Moona, DG, C-DAC, Dr. P. K Sinha, Sr. Dir. (HPC), C-DAC, Pune, Shri J. Satyanarayana, Dr. G.V Ramaraju, Scientist G & Group Coordinator (R&D in IT), DeitY, GoI and Dr. Hemant Darbari, ED, C-DAC, Pune.

Advanced Computing For Human Advancement

C-DAC/Media & Communications /Annual Report/2013