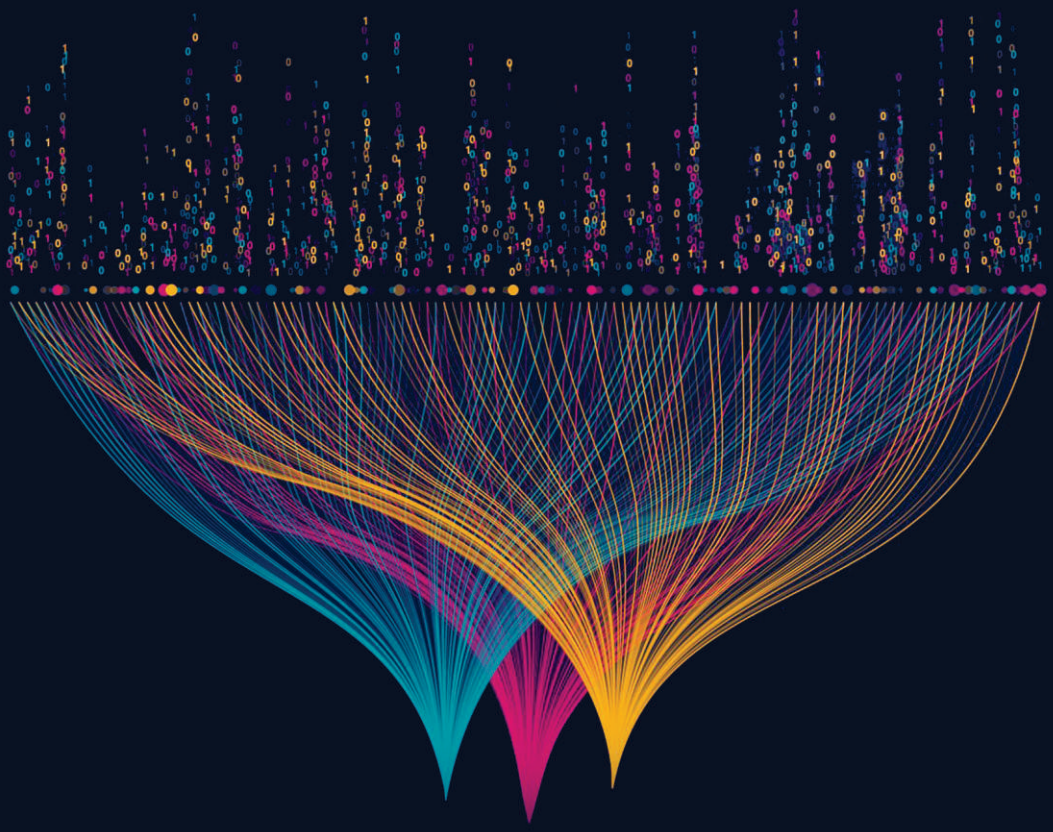

ANNUAL REPORT
2020-2021

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

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One Vision. One Goal... Advanced Computing for Human Advancement...

Governing Council

(As on 31st March 2021)

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Dr. Hemant Darbari
Director General,
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Shri Sunil Misar
Registrar-in-Charge, C-DAC and
Non-Member Secretary,
Governing Council, C-DAC

Contents

Overview

The year 2020-21 witnessed several technological accomplishments, events and recognitions for C-DAC. e-Sanjeevani- Telemedicine solution of C-DAC received the 'Digital India Award 2020' from Shri Ram Nath Kovind, Honourable President of India during the function held on December 30, 2020 under the "Innovation in Pandemic" category. Sagar Manthan - The Mercantile Marine Domain Awareness Centre (including LRIT National Data Centre) was launched by Shri Narendra Modi, Honourable Prime Minister of India on March 02, 2021 where Long Range Tracking System (LRIT) system was developed by C-DAC. Shri. Vijay Rupani, Chief Minister of Gujarat virtually handed over the indigenously developed PARAM Shavak Supercomputers by C-DAC to ten universities and higher education institutes of Gujarat State on December 14, 2020 to strengthen educational infrastructure in the state. "PARAM Siddhi – AI" is by far the fastest Supercomputer in India and ranked No. 62 position in 'TOP500 Supercomputer List – November 2020' declared at Supercomputing Conference 2020 held through virtual mode at the United States. NMPB multimodal Helpline to address specific issues of Medicinal and Aromatic Plants was launched by Shri Shripad Yesso Naik, Hon'ble Minister of State (IC), Ministry of AYUSH on October 13, 2020.

Under Phase-II of National Supercomputing Mission, MoUs were signed between C-DAC and nine host institutes including IITs on October 12, 2020 for the establishment of Supercomputing facilities. C-DAC also signed MoUs with 4 IITs for establishment of Nodal Centres for training in HPC and AI. C-DAC installed PARAM Yukti (838 TFLOPS) at JNCASR Bangalore and PARAM Sanganak (1.66 PFLOPS) at IIT Kanpur under 'Build Approach' in Phase II. C-DAC's indigenous server platform Rudra is based on Intel Xeon 2nd Generation Scalable Processor (Cascade lake) and is aimed for multi PF cluster. 'Trinetra-A' platform (100 Gbps*6 = 600 Gbps full duplex, aggregate) was developed and trials of the same with Rudra server platform were carried out. C-DAC's PARAM Yuva II system helped to process more than 4,79,454 jobs till March 2021 from 133 different institutions spread across the country. PARAM Sanganak has processed 62,517 jobs and PARAM Yukti has processed 33,218 jobs till March 2021. C-DAC provided Drug Discovery Tool Room (DDTR) with access to NSM computing along with software platform for Drug discovery. It enabled around 400 users on DDTR platform. PARAM BioEmbryo with peak performance of 100 TF installed at C-DAC Pune, caters to the Bioinformatics community in India and abroad. Frameworks such as BioAviator (a bundled Bioinformatics Cloud solution) and AnvayaNGS to accelerate NGS Genomics Data Analysis were developed. Performance of Hydrogen Bond Analysis Tool was enhanced in terms of h-bond calculations.

During last financial year 2020-21, C-DAC has carried out development and customization of transliteration solutions for Survey of India and Government of Telangana. In Speech-to-Speech MT domain, deployment of the complete UAT system with Automatic Speech Recognition (ASR) and Text to Speech (TTS) system has been developed for Office of Principal Scientific Advisor (PSA). C-DAC has provided customized solution for transliteration of the place names in the Survey of India (SOI) Digital topographical database from Devanagari to all 22 official Indian languages. Transliteration API is used in the application "Dharani" for the land records project of the Government of Telangana for transliteration buyer and seller names from Telugu to English and Vice-Versa. In Digital Preservation and Heritage Computing, C-DAC carried out Digitization of Manuscript including Repository and Retrieval System for Acharya Jogesh Chandra Purakriti Bhaban (District Museum) Bishnupur, Bankura, West Bengal, Indo-Bhutan e-Library.

Indigenously developed VEGA series of Microprocessors by C-DAC was leveraged for 'Swadeshi Microprocessor Challenge', launched by MeitY benefitting many participants including start-ups. Emergency Response Support System (ERSS) was successfully operationalized in 26 States and 8 Union Territories. Chittaranjan Locomotive Works (CLW) manufactured Tejas Express locos for 'push-pull' operations with aerodynamically designed class WAP-5 passenger electric using C-DAC's Vehicle Control Unit. Field trials of National Common Mobility Card (NCMC)-

compliant Centralized AFC Eco-System were carried out for Transit Operators at Wadala and Colaba Depots of Brihanmumbai Electricity Supply and Transport (BEST). The deployment and field trials of QR ticket system was initiated in collaboration with BEST and Bangalore Metro Rail Corporation Limited (BMRCL). With the collaboration of C-DAC and the Directorate of Urban Land Transport (DULT), Hubballi-Dharwad Bus Rapid Transit System Company (HD-BRTSCo) commissioned the Adaptive Traffic Signalling System at 32 junctions and 2 pedestrian midblock crossings in Hubli-Dharwad BRTS Corridor, Hubballi, and ATCS Command Control Centre at Hubballi. The Transfer of Technology (ToT) of Micro TETRA Base station, along with its software components, was carried out on November 27, 2020 to the industry partners.

C-DAC developed an online facility for EPFO which enabled processing of 2.31 Crores Provident Fund advance claims and disbursed funds amounting to Rs. 44,374 Cr since the start of the Pandemic. Long-Range Identification and Tracking (LRIT) system, which provides global identification and tracking of ships, went live successfully in April 2020 and DR Site went live in August 2020. C-DAC developed and deployed an Enterprise Management Suite to manage and monitor the BOSS Client machines in Defence Services Staff College (DSSC). BOSS Enterprise Management Solution and Secured BOSS OS were deployed for defence establishments. Total 4,055 departments / agencies got integrated using Mobile Seva platform. 61 webinars were organized on 'Digital Content Access and Sharing in Indian languages' under Vikaspedia in various languages.

C-DAC's eSign service – Online Digital Signing service- offered more than 2.54 Crores signatures for various agencies. Total 271 services were integrated and around 13.92 Crores transactions were completed using e-Pramaan – Online eAuthentication System. Cyber Security Architecture for Tamil Nadu was implemented by ELCOT in collaboration with C-DAC. Cyber Forensic Solutions were upgraded and deployed for key agencies in India and abroad. C-DAC team is setting up Cyber Forensics Laboratory cum Training Laboratory in the State of Arunachal Pradesh. During the year, C-DAC audited and certified approximately 435 applications / network infrastructure. C-DAC team actively contributed towards Information Security Education Awareness (ISEA) activities through various awareness workshops and master trainer trainings.

As part of National roll-out of its Health Informatics solutions, C-DAC created telemedicine solutions (eSanjeevaniAB), Artificial Intelligence based Medical Image Analysis, development of a ML based system to assist medical practitioners, Healthcare Data Analytics, etc. C-DAC's e-RaktKosh reached more than 2,100 blood banks in 32 States / UTs across the country. With inclusion of DMER Maharashtra & Puducherry, e-Aushadhi's deployment tally increased to 25 Instances in India covering 18 States, 2 Union Territories, 5 National Programs under MoH&FW. C-DAC continued proliferation of its Hospital Management Information System at various hospitals including HMIS Punjab, AIIMS Raipur, AIIMS Bathinda, AIIMS Nagpur and AIIMS Bhubaneswar. During the year, C-DAC signed MoU with State of Tamil Nadu, Directorate of Medical Education and Research, Government of Maharashtra & State of Odisha regarding e-Upkaran which has been deployed in 9 States. C-DAC's SNOMED CT Toolkit (CSNOtk) v6.5 provides the APIs and software tools for simple and rapid integration of SNOMED CT in healthcare applications and provides support in Sanskrit, Tamil and Urdu Languages.

C-DAC continued to impart its various industry- specific Post Graduate Diploma programmes, industry-academia collaborative programmes, IT trainings and skill development programmes throughout the year. C-DAC conducts the Comprehensive Recruitment for Air Force Common Admission Test (AFCAT) and Central Airmen Selection Board (CASB/STAR) using its indigenously developed solutions. For AFCAT and CASB/STAR, C-DAC conducted recruitment process for more than 10.22 lakh candidates in the year 2020-21. Under Pradhan Mantri Gramin Digital Saksharta Abhiyaan (PMGDISHA), C-DAC was registered as one of the assessment agencies and proctored 22.5 lakh students during the year. MeghSikshak, an advanced Learning Management System (LMS), was deployed at the Bureau of Police Research & Development (BPRD) and Maharashtra Police Academy. A total of around 48,493 teachers covering around 12,093 schools across India were trained for rollout of Online Labs (OLabs).

The above-mentioned activities have resulted in several research publications, patents, awards, recognitions and new collaborations with academic organizations within the country and abroad.

The annual report covers the achievements and major activities of C-DAC during the year 2020-21.

Major Activities in Thematic Areas

High Performance Computing (HPC), Cloud Computing and Big Data

C-DAC has been at the forefront of High-Performance Computing (HPC) for more than three decades. It is actively engaged in indigenous R&D in HPC Components (including processor, server board, interconnect, cluster, and cooling system), HPC System Software, HPC Applications, HPC Solutions and Services, Grid Computing, Cloud Computing and Big Data & Analytics along with design, development, and deployment of peta-scale computing machines across the country under the National Supercomputing Mission (NSM)approved in 2015 by Cabinet Committee on Economic Affairs (CCEA). A summary of activities carried out by C-DAC in this thematic area during 2020-21 is given herein.

National Supercomputing Mission (NSM)

Approved in 2015 by Cabinet Committee on Economic Affairs (CCEA) to be implemented jointly by MeitY and DST, with IISc Bangalore and C-DAC being the executing agencies, National Supercomputing Mission (NSM) comprises of building of Supercomputing systems, Application development, Human resources development and R&D towards Exascale capability. Building of Supercomputing systems is being implemented in three phases: Phase 1 – Assembly of subsystems in India, Phase 2 – Manufacturing of subsystems in India and Phase 3 – Design and manufacturing in India.

HPC Systems under NSM

PARAM Siddhi-AI

"PARAM Siddhi – AI", is by far the fastest Supercomputer in India and ranked at No. 62 position in 'TOP500 Supercomputer List – November 2020' declared at Supercomputing Conference 2020 held through virtual mode at the United States. PARAM Siddhi - AI of 210 AI Petaflops with 2.4 million Cores and 6.5 Petaflops Peak DP is based on the NVIDIA DGX SuperPOD reference architecture along with indigenously developed HPC-AI engine, Software Frameworks and Cloud Platform by C-DAC. It aids research in advanced materials, Computational Chemistry & Astrophysics, Health care system, Disaster Management and applications related to COVID-19 through faster Simulations, Medical Imaging, and Genome Sequencing.

PARAM Siddhi-AI

HPC System Deployments

C-DAC installed PARAM YUKTI (838 TFLOPS) at JNCASR Bangalore and PARAM SANGANAK (1.66 PFLOPS) at IIT Kanpur under 'Build Approach' in Phase II during the year. HPC systems at IISc Bangalore, IIT Hyderabad, IIT Guwahati, IIT Gandhinagar, IIT Mandi, NIT Trichy, NAABI Mohali and C-DAC Bangalore under Phase II are currently at various stages of deployment. On acceptance of said systems, cumulative compute capacity of HPC systems installed under Phase I and II will be 16.6 PF. The systems across three phases of NSM cater to computational demands of academia, researchers, MSMEs and start-ups in areas like oil exploration, flood prediction and drug discovery among many others of national importance. Substantial components utilized to build these Phase-II systems are manufactured and assembled within India, which is a step towards the 'Make in India initiative' of the Government. These systems use C-DAC's indigenous system software stack comprising of C-Chakshu, CHReME, OSTicket, OpenHPC, Lustre, PARAview, MVAPICH2, Intel Cluster Studio, GNU Tools, CUDA Toolkit and others. The facilities under Phase I and II along with systems under Phase-III will be accessed by 75 institutions and thousands of active researchers, academicians on National Knowledge Network (NKN) - the backbone of Supercomputing systems. Currently more than 1800 HPC users are using these Supercomputing systems and these systems have processed more than 15 Lakhs HPC jobs.

PARAM Yukti

Param Yukti with a peak computing power of 838 Teraflops was designed to cater to the computational needs of Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore and various Research and Engineering institutes of the region. It is based on Intel Xeon Cascade Lake processors, NVIDIA Tesla V100 and HDR100. The system offers storage of 1 Petabyte with a high-performance parallel file system and archival subsystem. PARAM Yukti processed 33,218 HPC jobs till March, 2021.

PARAM Yukti

PARAM Sanganak

PARAM Sanganak established at IIT Kanpur has a peak computing power of 1.66 PF. It is configured with dense compute nodes having the Intel Xeon Cascade Lake CPUs to achieve maximum computing performance per rack. The nodes are connected over high-speed and low latency 100Gbps InfiniBand network for faster inter-node communication. The system has a storage of 2 Petabyte with a high-performance parallel file system and archival subsystem. It is useful for the research needs of varied scientific domains such as Weather & Climate, Oil & Gas, Seismic, Life, and Material sciences, etc. PARAM Sanganak processed 62,517 HPC jobs till March, 2021.

PARAM Sanganak

PARAM NEEL (ARM)

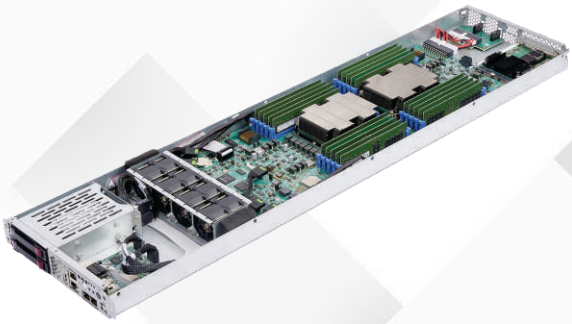
PARAM NEEL installed at C-DAC Pune is designed and developed around Arm8.2-A SVE 512-bit architecture. It consists of 40 nodes each comprising of Fujitsu A64 FX processor HBM2 32 GiB memory. It has HDR InfiniBand interconnect and 650 TB of storage. Cluster is assembled with an objective to explore different emerging processors (Intel, Power9, AMD and ARM) for development of future HPC systems.

PARAM ARM

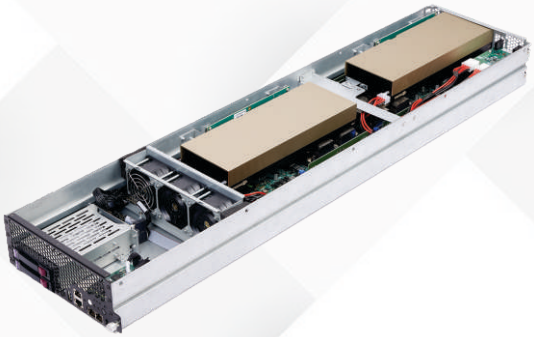
Build Approach Developments under NSM

Indigenous Server Platform: Rudra

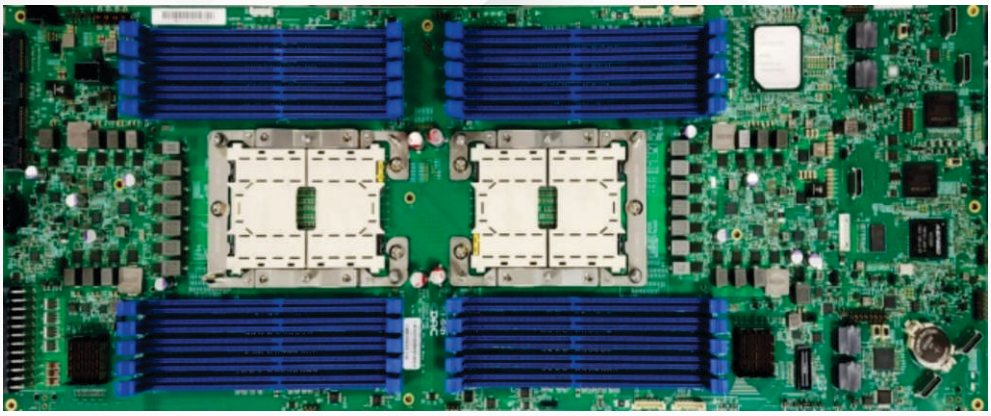
Rudra is a dual socket server platform based on Intel Xeon 2nd Generation Scalable Processor (Cascade lake) supporting DDR4 Memory up to 3 Terabytes, 100G HDR InfiniBand NIC with two Expansion slots for GPU and Trinetra NIC. The Rudra platform is designed for ½ width 1U for CPU only and ½ Width 2U dense form factor with GPU cards. It is compliant to Open19 standard form factor for 1U and 2U and is aimed for multi-PF cluster. Rudra based server system from C-DAC is the first of its kind made in India to meet the HPC requirements in the country.



Rudra 1U Server



Rudra 2U Server



Rudra Server Motherboard

Indigenous HPC Network – Trinetra

'Trinetra-A' platform (100 Gbps*6 = 600 Gbps full duplex, aggregate) was qualified successfully on 12-node test cluster which is being validated using in-house stress testing applications, as well as industry standard MPI based benchmarks. First trials of 'Trinetra-A' hardware and software with Rudra server platform were carried out. Design of next generation 'Trinetra-B' platform (200 Gbps*10 = 2 Terabits/sec full duplex, aggregate) is under way with first prototypes expected by December 2021.

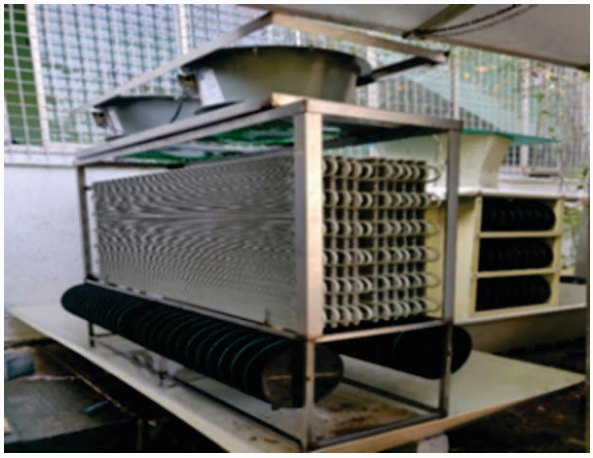
Trinetra-A NIC

Trinetra-A based 12-node test cluster

Direct Contact Liquid Cooling (DCLC) System

A modular PWC_A & IEC (Panel Water Cooler with Provision of Air and Indirect Evaporative Cooling) to handle 3 kW heat load generated from a DCLC based HPC system was developed. A 30 kW PWC_A&IEC was designed and fabricated at the Heat Pump Laboratory at IIT Bombay. The waterside flow cross-section area and heat transfer area are increased to improve the overall performance. A modular Coil-on-Chip Liquid Cooling for processors was designed to handle heat loads up to 360 W from a 50 mm x 50 mm base on chip. Its extrusion design, die development and the assembly got completed. CFD simulations helped in optimizing the configuration of chip liquid cooling system.

A 3 kW Panel Water Cooler installed at C-DAC Pune



A 30 kW Panel Water Cooler developed at IIT Bombay

HPC System Software

C-DAC Automatic Parallelizing Compiler (CAPC)

CAPC provides a fast and effective solution for code parallelization by automatically converting a sequential C code to a corresponding parallel code. Generated parallel code runs much faster on parallel devices such as multicores and GPUs. It liberates the programmer from effort of learning new languages for programming parallel devices. During the year, C-DAC was engaged in design and development of CAPC v2.0 for GPU support with OpenMP 4.5.

Parallel Development Environment (ParaDE)

ParaDE is a web-based platform that helps to create parallel applications on HPC platforms. It enables users to just login to the environment and use all software on the cluster without the hassles of installation or configuration on the client machine. C-DAC completed the design and development of enhanced features in ParaDE v1.0 and installation of ParaDE v1.0 on NSM PARAM Spoorthi during the year.

C-Chakshu ver. 2.5

C-Chakshu is a Multi-cluster Monitoring & Management Platform to address effective usage of deployed HPC systems by comprehensive monitoring. It provides a unified dashboard over the web for all NSM sites with different geographic locations across India. Its web-enabled interface manages clusters of varied configurations and facilitates system administrator making it easy for the researchers and scientists of varied domains to run their scientific applications with minimal efforts.

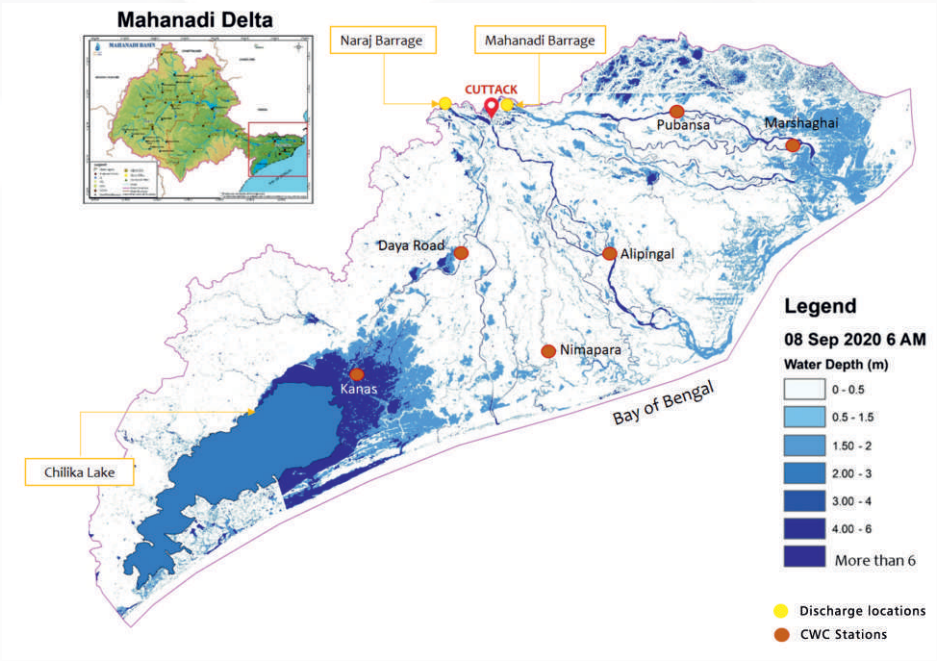
OS Ticket 2.0

It is an open-source utility customized to integrate inquiries via email and web-based forms into a simple easy-to-use multi-user web interface. It manages, organizes and archives requests from users and responses from support in one place while providing users with accountability and responsiveness. It is deployed on PARAM ShivaY, PARAM Shakti, PARAM Brahma, PARAM Yukti, PARAM Sanganak and PARAM BioEmbryo.

Applications Development under NSM

Early Warning System for Flood Prediction for River Basins of India

Early Warning System for Flood Prediction is being developed for Mahanadi River Basin at the behest of the user agency Central Water Commission (CWC). After successful completion, it may be replicated for other River Basins of India. The prediction simulation is being aided by open-source software tool for 2D hydrodynamic modelling, suitable for predicting the consequences of riverine flooding. During the monsoon season, daily predicted inundation outputs were shared with CWC for validation and inputs.



Simulated output for Part Mahanadi River Basin (2020)

Multi-Sectorial Simulation Lab and Science Based Decision Support Framework

Estimates of Change in LULC on surface meteorology over northwest India: Impact of urbanization

The impact of Land-use and Land-cover (LULC) changes which occurred in a decade (2006 – 2016) was quantified on surface level meteorological parameters and Urban Heat Island (UHI) intensity using Weather Research and Forecasting (WRF) model. The analysis focused on eight major metropolitan cities of northwest India in the states of Rajasthan and Gujarat, which witnessed the highest expansion of urban areas during this decade.

Simulation of Heavy Rainfall events observed over Pune region using WRF model

Several heavy rainfall events were observed over Pune city and rest of the Maharashtra between 2014 and 2019. Total accumulated daily rainfall during these events ranged between 64 mm to 123 mm according to IMD. WRF ver. 4.2.1 was used to simulate events at a high resolution of 9x3x1 km. Sensitivity analysis was performed for six different

microphysics schemes available in WRF model (e.g., LIN, Ferrier, Goddard, Thompson, Morrison, WSM5) and two Planetary Boundary Layer (PBL) schemes (YSU, MYJ).

Contribution of Crop Residue burning to PM2.5 Pollution over Delhi

The study aimed at addressing to what extent the PM2.5 concentration in Delhi is attributable to agricultural burning in Punjab and Haryana and neighbouring Pakistan during severe pollution events. The contribution of crop residue burning in the states of India to surface PM2.5 concentration in Delhi during 2018 post-monsoon burning season was quantified by combining in situ observations, satellite fire observations, FINNv1.5 fire emission inventory, and WRF-Chem V3.9.1.

Set-up of Air Quality Forecasting System

The forecasting system over Delhi was upgraded using surface observations from Central Pollution Control Board (CPCB) air quality network, satellite fire observations (MODIS fire activity data) and high resolution LULC data prepared using sentinel satellite data. The assimilation lead to improved efficiency in the forecasting over Delhi.

Computational Fluid Dynamics (CFD) Activities on Urban Modelling

This initiative intends to develop a multi-scale modelling, data environment and decision support framework with meteorology, air quality, CFD and hydrology models using HPC. OpenFOAM, open-source CFD simulation software is being used to study the micro-scale simulation studies of wind and dispersion of pollutants. Experiments were undertaken to obtain refined boundary layer mesh by taking a case of a one square km building area, and steady state wind flow simulations were carried out at different uniform wind speeds (up to 21 kmph).

Simulation of a Heat Wave Event observed over Ahmedabad

The main objective was to evaluate the performance of WRF model in predicting the heat wave events that was witnessed over Ahmedabad city during May 18-20, 2016 and June 01-03, 2019. WRF ver. 4.2.1 was used to simulate the events at a high resolution of 1 km grid. The result showed that schemes were able to capture the diurnal temperature pattern. Pleim-Xiu scheme showed very poor result in the simulation while unified Noah scheme showed better results among all the schemes used. But still, none of the schemes was able to capture the maximum temperature.

Urban Flood Warning System

It comprises of fully coupled urban meteorology and hydrology modelling system to improve urban flood forecasting. It calculates contribution of catchment runoff to river due to rainfall other than dam discharge. Rainfall-runoff simulation was carried out using HEC-HMS in Mula Mutha catchment and output was validated with data from Water Resource Department.

HPC software suite for seismic imaging to aid oil and gas exploration

SeisRTM is Reverse Time Migration (RTM) software for seismic imaging of complex structure under the earth. It is developed using NSM servers which helps in saving the processing cost. This will be customizable for Indian geological subsurface structures. 2D FD ISO Modeler and 2D ISO RTM are developed. Testing of these applications using field data is ongoing.

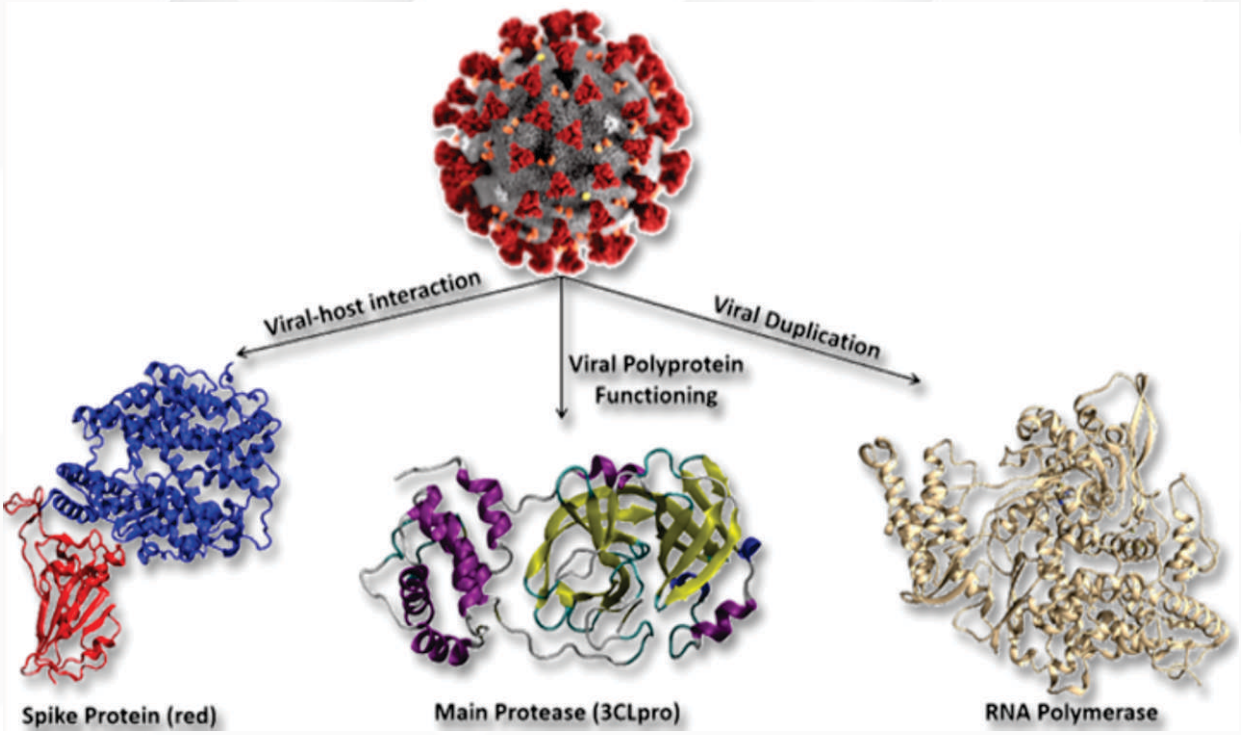
Application Porting, Optimization and Scaling services under NSM

20+ applications from Bioinformatics, Molecular dynamics, Climate modelling, Weather prediction and Disaster management along with DL software stack were ported and enabled across NSM sites. Acceptance tests were carried out as per NSM Mission document guidelines. HPC applications were ported and benchmarked on different architectures including Intel, AMD, IBM Power9 and ARM. JupyterHub was integrated with slurm scheduler on PARAM Sangam and PARAM Shakti clusters. A FAQ Portal was developed and integrated in ticketing tool at all NSM Sites.

Drug Repurposing Study on SARS-CoV-2 proteins using HPC for Antivirals & Ayurvedic phytochemicals

Three crucial COVID19 targets viz. RNA polymerase (RdRp), Main protease (3CLpro) and Spike protein which are involved in various functions of coronavirus were studied for drug repurposing and studying inhibitor role of

phytochemicals from Ayurvedic plants. Molecular modelling expertise gained in performing high-end simulation studies on large cancer related proteins, membrane proteins and metal complexes, helped to deal with proteins involved in COVID19.



SARS_COV2 proteins studied

Sequence based classifier

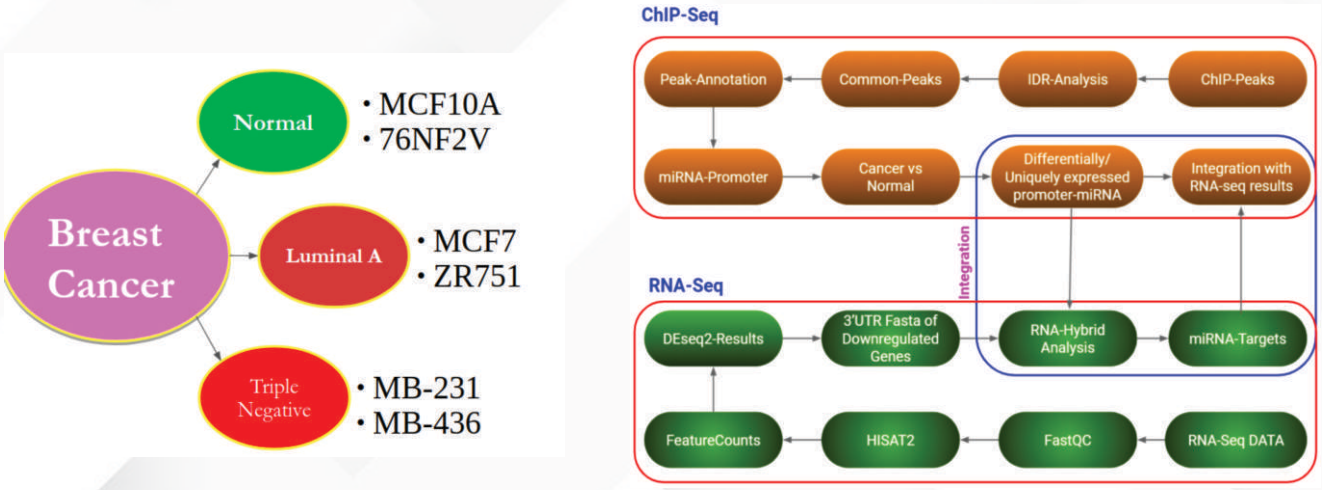
This initiative is to understand allele frequency variation of ACE2 gene, the protein product of which is the receptor for SARS-COV-2 virus causing COVID. AI framework, in particular semi-supervised ML layers, was used which helped in leveraging patterns in variants of ACE2 genomic data to improve power in the training and prediction of ACE2 genome classification.

A Pandemic calculator for estimating population epidemiology scenario in India

Pandemiculator (Pandemic Calculator) uses statistical and mathematical epidemic models to predict the number of cases infected with COVID-19 (SARS-nCOV-2 virus caused disease). The goal was to showcase the current scenario in India and predict the number of infected cases using regression in a population along with the growth factor using mathematical models like ARIMA and SEIRD to help the agencies better understand, mitigate and suppress its spread. The clustering of population helped in understanding risks based on clinical parameters of various age groups and to develop vaccination strategy with the help of SEIRV model.

ChIPseq-RNAseq Integration Analysis

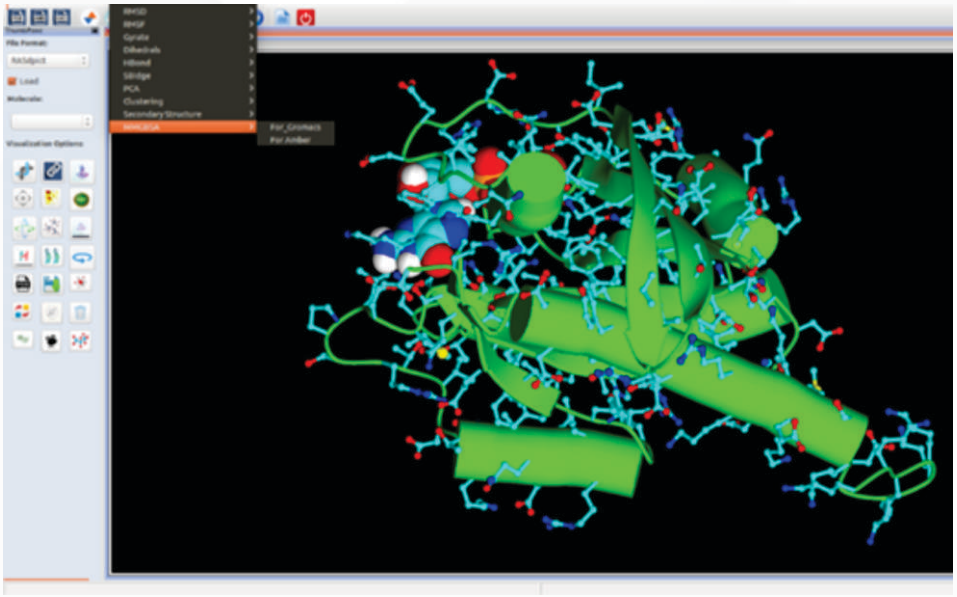
Breast cancer is one of the leading forms of cancer in women all over the world. Epigenetic modifications influence differential expression of genes through non-coding RNA and play a crucial role in cancer regulation. Epigenetic regulation of gene expression was carried out by in-silico analysis of histone modifications using chromatin immunoprecipitation sequencing (ChIP-Seq) under this initiative. Eight miRNAs present in at least three breast cancer cell-lines (miR4512, miR6791, miR330, miR3180-3, miR6080, miR5787, miR6733 and miR3613) and not observed in normal-like cell-line were found to be differentially regulated.



Datasets used in the study and Workflow for integrative analysis of ChIP-seq and RNA-seq

DPICT: Molecular Dynamics Visualization and Analysis Tool

C-DAC is engaged in the development of DPICT: Advanced Molecular Dynamics Visualization and Analysis tool to support simultaneous viewing of multiple trajectories. It reads file formats like AMBER, GROMACS etc. to carry out analyses on structural parameters, in a parallel manner. Multi-threading has been incorporated to improve the performance of the tool. Output from various calculations is exported to graph plotting software.



A snapshot of Dpict View Panel

NSM Human Resource Development

Along with deployment of wide-ranging Supercomputing infrastructure, till date C-DAC has trained a next generation of supercomputer- aware manpower comprising of more than 7500 students, researchers, and faculties through organization of Faculty Development Programs, Workshops, Bootcamp and Hackathon. In October 2020, a 4-day workshop was organized on HPC and DL for GUJCOST Gujarat.

HPC Shiksha

HPC-Shiksha is an online training platform to host and conduct HPC oriented training modules which can scale up to thousands of simultaneous learners globally. It provides a rich and flexible empowering tool for both learners and instructors through interactive forums and interactive boards, learners & instructor dashboards. C-DAC signed MOUs with IIT Kharagpur, IIT Madras, IIT Goa and IIT Palakkad for establishing NSM Nodal Centres for training in HPC

and AI in the presence of Hon'ble MoS, Shri Sanjay Dhotre in October 2020. Considering prevailing pandemic situation, it was decided to conduct courses in online mode. First course was "Basics of HPC" spread over 13 weeks and conducted by faculty from IIT Kharagpur, IIT Kanpur IIT Goa, IIT Palakkad, IIT Tirupati, NVidia and C-DAC. 800+ participants covering students and working professionals attended the same. Second course "Introduction to ML" spread over 7 weeks was attended by 600+ participants covering students and working professionals, and was conducted by faculty from IIT Madras, IIT Goa & NVidia . In addition to the above, C-DAC also conducted training on HPC & AI to students from JNU New Delhi and SPPU Pune using HPC Shiksha. More than 1500 participants have been trained under NSM.

HPC Tutor

HPC Tutor is a hands-on utility developed for conducting HPC training. It consists of instruction dashboard with integrated hands-on terminal. It is used to impart practical knowledge and skill related to HPC amongst novice and expert users.

SAMHAR Covid19 Hackathon

In association with NVidia and OpenACC, C-DAC conducted SAMHAR-Covid19 - Supercomputing hackathon using AI, ML, Healthcare Analytics- based Research for combating COVID-19 along with Industry & Start-ups as a pro-active response during the global pandemic. The objective was not just to solve current Covid-19 situation but to prepare the research community to make use of HPC-AI tools and keep ready to predict outbreaks like this. From 450+ submissions against the call, 25 teams were selected to create prototypes. Each team was provided access to NVIDIA DGX-1 AI Supercomputer Cluster. Six winners were awarded for their unique solutions.

Drug Discovery Hackathon 2020 (DDH2020)

DDH2020 was a joint initiative of AICTE, CSIR and supported by Office of Principal Scientific Advisor, Government of India, NIC and MyGov. DDH2020 vision and mission was to establish 'Open innovation Model' for In-Silico Drug discovery against Covid-19 virus and covers various processes in drug discovery, including but not limited to, In-Silico screening of molecules, lead optimization and identification of drug-able non-toxic targets. C-DAC provided Drug Discovery Tool Room (DDTR) with access to NSM computing along with software platform for Drug discovery. It enabled around 400 users on DDTR platform.

GPU Application Hackathon 2020 (GAH – 2020)

In collaboration with NVidia, an online OpenACC hackathon (GAH – 2020) was conducted during August-October, 2020 to investigate and implement scientific applications with latest parallelization and optimization techniques on GPGPUs. Eleven teams from premier Institutes such as IISc Bangalore, Institute of Plasma Research (IPR) Gandhinagar, IIT Madras, IIT Bombay and BIT Mesra participated. The domains of applications covered Plasma, CFD, MD, Astrophysics and Aerospace Engineering. The teams were guided by 20 mentors including from Nvidia, C-DAC and IIT Mumbai.

Supercomputing Systems and Facilities

PARAM Yuva II

Since its commissioning in February 2013 at C-DAC's National PARAM Supercomputing Facility (NPSF), PARAM Yuva II has been widely used by scientists and engineers for research. It has processed 4,79,454 HPC jobs till March 2021. Utilization of NPSF has remained above 90%. 1247 users including 296 PhD scholars across 133 institutions executed their jobs on PARAM Yuva II for scientific research covering many cross functional domains. 64 PhD scholars completed their PhD and 441 publications have been published with the use of the system. NPSF resources were offered for Innovations under nation-wide Hackathon.

PARAM Shavak

PARAM Shavak is an affordable supercomputing solution in a box that aims to provide computational resources with advanced technologies to perform high-end computations for scientific, engineering, and academic programs to address and catalyse research using modelling, simulation, and data analysis. During 2020-21, 14 PARAM Shavak

HPC systems and 5 PARAM Shavak DL GPU systems were deployed at various client locations including at MNNIT Allahabad, IIIT Kurnool, University of Burdwan, DSCI New Delhi and NexGen CoE IT in Jordan.

HPC facilities

- C-DAC was engaged in upgradation and maintenance of Supercomputing infrastructure for ICAR-IASRI.
- C-DAC set up HPC facility at CoE IT & HPC at Namibia University of S&T in Windhoek Namibia during the year under the Ministry of External Affairs (MEA) initiative.

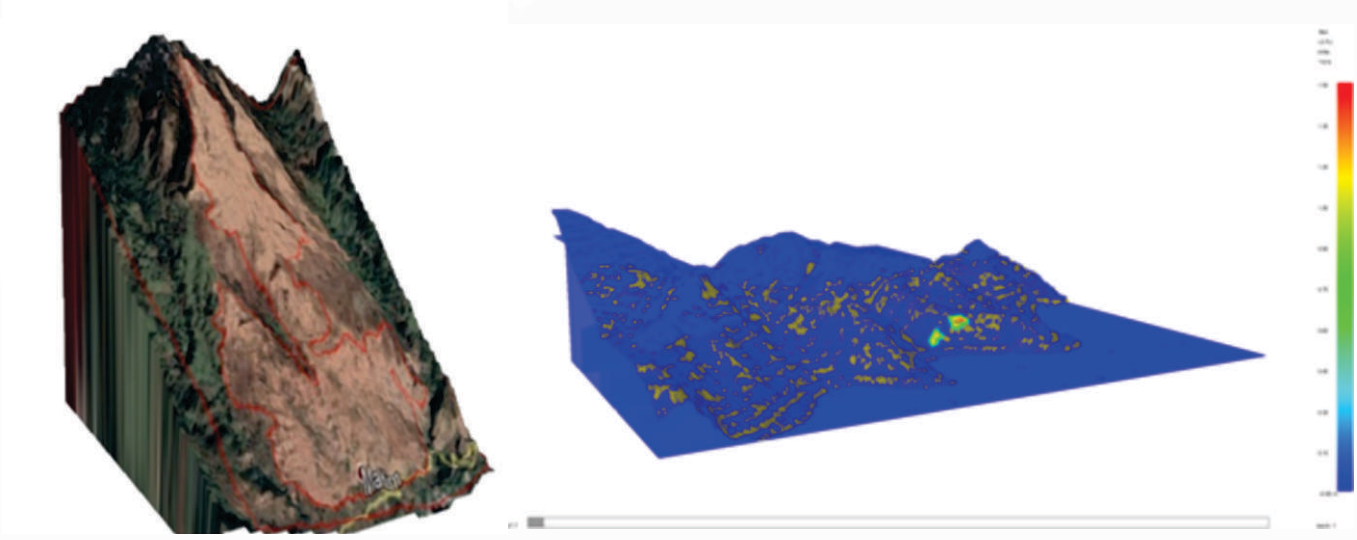
HPC Applications

Large scale model of the Himalayan crust

Large scale model of the Himalayan crust using finite difference modelling of high and low frequency nearfield data and its effect on strong ground motion in central seismic gap region of Himalaya has been devised. It is for generation of subsurface SH waveform propagation results. P-wave imaging is affected by bulk modulus of medium; SH-wave imaging depends only on the density and shear modulus of the medium and thus is independent of water content. SH-wave imaging provides much higher resolution than P-wave Imaging.

Forest Fire Spread Model

Forest Fire Spread Model based on Satellite Remote Sensing and Computational Models using HPC System was devised. Different CFD software (WRF-Fire, WRF-SFIRE, WFDS and FDS) were explored to develop models for simulation of forest fire spread. The burnt area of previous forest fires of Sikkim region was mapped using satellite data. Using WFDS, Sikkim North district, Sikkim West and Sikkim South terrain were simulated. The WFDS-9977 parallel solver has shown a scale up of 13X as compared to serial processor on Sangam HPC cluster using 27 processors.



Simulation of Sikkim North District Terrain and Sikkim South District Terrain Fire Spread using WFDS

Panorama Phase II - Marine Forecast Visualization System

Panorama is a GIS-based marine weather decision support system, developed for Directorate of Naval Oceanology and Meteorology. It processes numerical weather and ocean state global and regional forecast output, global observations and satellite images to aid operations at sea. It enables user-friendly onboard 2D & 3D visualization of atmosphere and ocean forecast for 10 days. Automated system facilitates real-time data download from multiple sources, database management, data compression, multi-parameter visualization, extreme event analysis, alerts and real-time data dissemination to ships sailing across the globe. It acts as an end-to-end operational decision support system for on-board ships.

Cloud Computing

AnvayaNGS

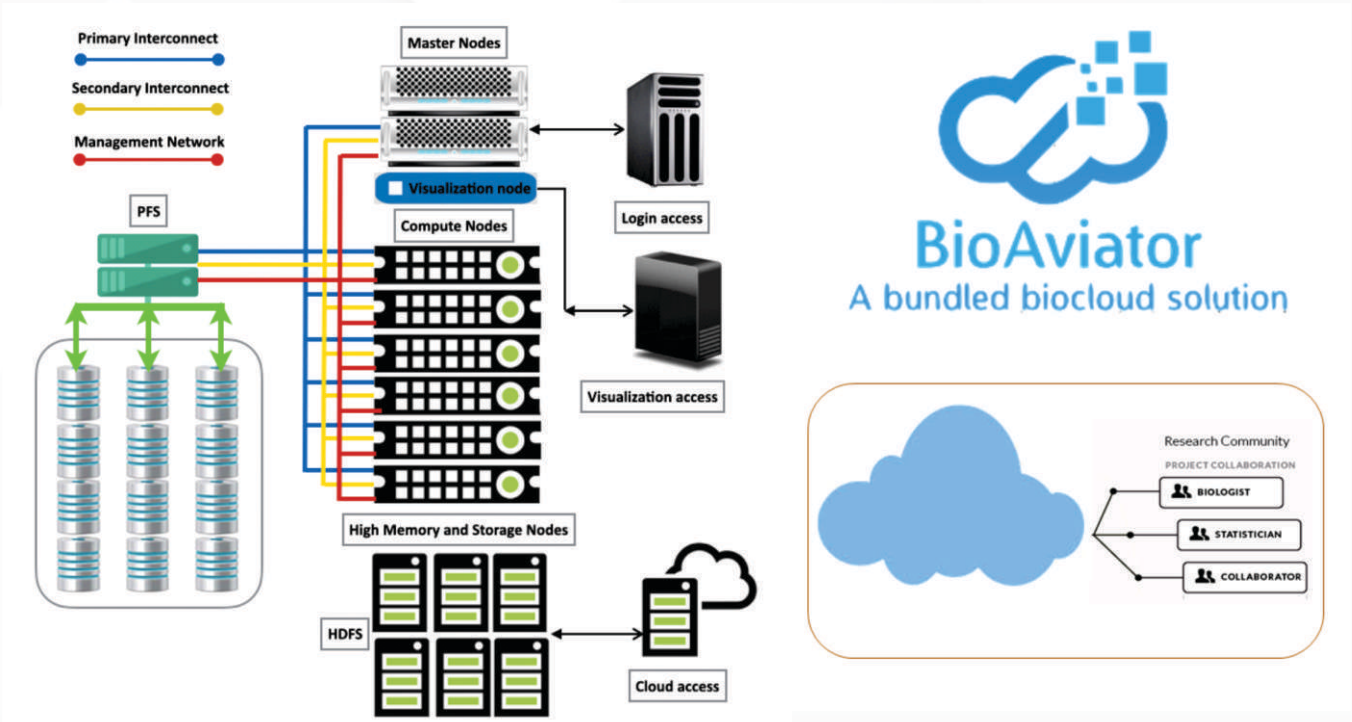
AnvayaNGS provides a workflow environment for high throughput Comparative Genomics. It is an interface to Bioinformatics tools and databases, that are loosely coupled together in a coordinated system to execute a set of analyses tools in series or in parallel. It is deployed at ICAR-Indian Agricultural Statistics Research Institute (IASRI) New Delhi and Dr. Punjab Rao Deshmukh Krishi Vidyapeeth Akola.

Meghdoot - Software Suite

Meghdoot is a comprehensive cloud suite developed by C-DAC that constitutes free and open source tools across all layers of cloud. Meghdoot cloud suite was enhanced with Stein version of OpenStack. It allows integration of Docker containers, bare metal provisioning with OpenStack ironic and enhancements with Observium monitoring.
This has been deployed at Tamil Nadu State Data Centre (TNSDC), Chennai and Tamil Nadu Disaster Recovery Centre Tiruchirappalli.

BioAviator

BioAviator is a bundled Bioinformatics Cloud solution to address Big Data analytics as well as computational needs of the Bioinformatics community. A framework has been built on powerful capabilities provided by the NGS analytics tools to efficiently execute in a commodity cloud computing environment as a private cloud. A Big data facility has been commissioned and installed at C-DAC Pune for deployment of Hadoop based Bioinformatics tools under BioAviator.



BioAviator: A bundled bio-cloud solution

GenoVault: A Cloud based Genomics Repository for genomics data

C-DAC is engaged in development of GenoVault, a Cloud based repository for handling NGS data. It is implemented using OpenStack Swift for Object Storage solution of genomic data both for archival and retrieval along with analytical engines. A standalone JavaFX based client is also developed for large file uploads. GenoVault has enormous importance in healthcare and is of great use in personalized medicine.

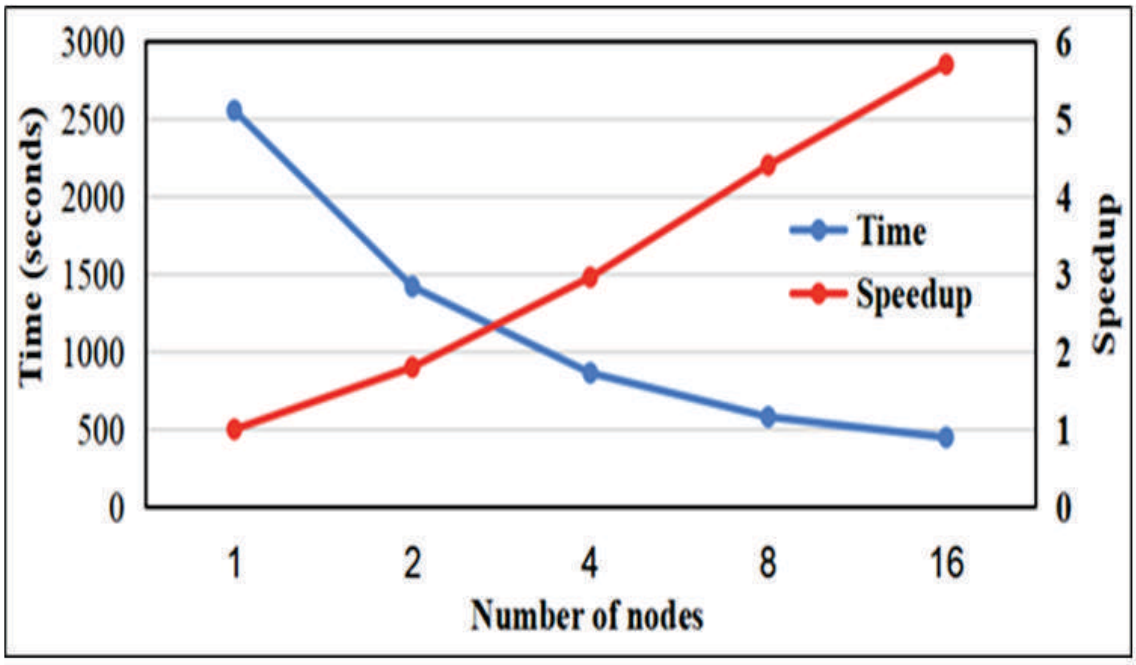
Big Data and Analytics

htVAM- A high throughput Variant Analysis Computational Methodology

htVAM is a toolkit with computational methodologies using High Performance compute clusters for variant calling of multiple samples at a single instance. Variant calling plays a significant role in genetic associations with disease and analysis of mutations in cancers. The challenge is to do joint Variant Calling which exploits immense parallelism on HPC clusters using Cloud Computing and map-reduce programming paradigm. VIVIDHA (Variant Analysis and Visualization Interface for Dynamic High Throughput Applications) developed under this initiative enables timely discovery of variants in large cohorts, thereby aiding in genotype-phenotype association studies.

HBAT - Hydrogen Bond Analysis Tool for Molecular Simulation Trajectories

HBAT is a Big Data analytics tool to analyse the hydrogen bonds in the molecular simulation trajectories. The nearest neighbour algorithm is used to boost the performance of the tool in terms of h-bond calculations. It is tested with various trajectories which vary in size and format such as PDB, AMBER and GROMACS having 10, 100, 1000, 10000 frames.



Benchmark results of HBAT on BioEmbryo

Multilingual Computing & Heritage Computing

Artificial Intelligence and Machine Learning play a vital role in various technologies that has huge impact on our lives. During the year, some of the key areas that C-DAC has worked on include Translation and Transliteration, Internationalized Domain Names (IDNs), Multilingual Mobile Applications, Speech Technologies, e-Learning technologies, Optical Character Recognition (OCR) to name a few. Multilingual and Heritage systems are developed using AI and Machine Learning.

Language Computing and Speech Technologies

Translation and Transliteration Technologies

Translation Engine

C-DAC has developed translation engine named "GIST Translation Engine" which is a State-of -art, using deep learning models, which aids in automated translations of the text from English to Indian language and vice versa. Translation engine is modified to improve the accuracy as well as has undertaken new development to include Marathi and Bangla languages. It is currently available for English to three major languages viz. Hindi, Marathi and Bengali.

Trasname-lite

C-DAC has provided customized solution for transliteration of the place names in the Survey of India (SOI) Digital topographical database from Devanagari to all 22 official Indian languages. This has been implemented in India's Topographical Maps. Also, C-DAC has developed SOI's Transliteration Table (Conversion Chart) from Devanagari to 11 Indian languages. Key Features of the product include - Efficient transliteration of large Indian name databases, Allows existing databases to be transliterated on the fly, Available as a library that can be integrated into a given application for transliteration as and when required by the module, The engine uses ISCII and UNICODE storage standards and is custom built to cater to all 22 Indian languages.

Transliteration Application Programming Interface (API)

Transliteration API is used in the application "Dharani" for the land records project of the Govt. of Telangana for transliteration of buyer and seller names from Telugu to English and Vice-Versa. Key Features of the solution include - Transliteration of names from Telugu to English and Vice-Versa, Allows users to type in Indian Language on each press or on each tab, Floating keyboard to assist uses in typing Indian Language content, and, The engine is hosted on LINUX server and accessed on Windows clients on IE, Chrome and Firefox browsers.

Speech Technologies with Machine Translation

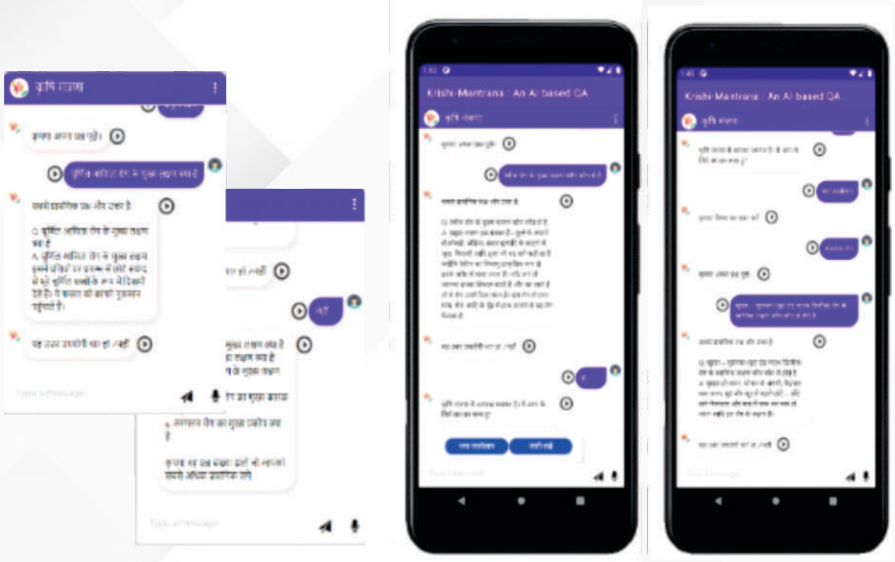
Speech to Speech Machine Translation (SSMT)

Speech to Speech Machine Translation technology plays a critical role in overcoming language barriers in India's multi-lingual context. Making science and engineering as well as other branches of knowledge available in Indian languages is perhaps the single biggest need today in education field. To overcome this barrier, C-DAC has under taken consortia mode project for Speech-to-Speech Machine Translation (SSMT) System with IIIT Hyderabad as collaborating agency. During the year, C-DAC has worked for Language resource enrichment by creating English-Hindi parallel corpus by translating the NPTEL lectures for programming and Health data and by identifying or generating the domain specific terms in Hindi. Also tried to bridge the technology gap by developing English to Hindi Machine translation (E-ILMT) system for Health and Programming (NPTEL lectures) by consortia. The System has been successfully integrated in the Speech-to-Speech Machine translation pipeline or with the translation work bench along with the other Machine translation system.

Krishi Mantrana: An AI Based Multimodal Dialog-System for Farmers

C-DAC with Birsa Agricultural University (BAU) Ranchi, Bihar Animal Sciences University (BASU), Patna is working together to develop an Artificial Intelligence based System to provide advice and to address farmer's field queries in Hindi and Bengali language. The Hindi QA system along with Hindi ASR and TTS has been developed and integrated

with a bespoke Widget for deployment across platforms. The application is deployed within the organization and is in the process of being hosted for Agricultural Institutes. Algorithm development for QA system, UI design and deployment of the complete UAT system with Automatic Speech Recognition (ASR), and Text to Speech (TTS) system have been successfully completed during the year. Furthermore, with rapid increase in data collection, more robust and start-of-the-art One Shot Learning based algorithm has been developed and presently is under integration.



Krishi Mantrana

Image processing and Analytics

Optical Character Recognition (OCR) engine and Image Analytics

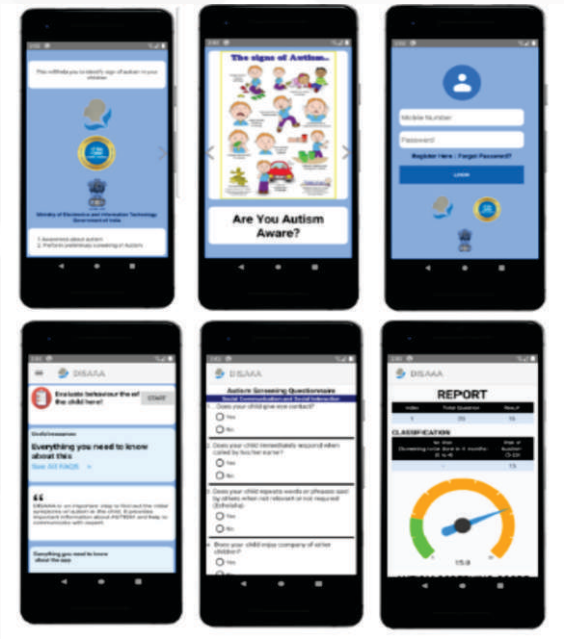
C-DAC has developed OCR using an encoder-decoder architecture with attention. This OCR takes scanned line images as input and produces text output that can be further consumed by applications for searching or analytics purposes. OCR developed earlier (for Hindi, Marathi, Bangla, Gurumukhi, Tamil, Malayalam, and Kannada) has also been enhanced for better accuracy. OCRs for Sanskrit, Modi, English, and Chinese are trained on synthetically generated line images. Some of the applications that are developed using OCR are - Indian language text extraction from digital PDF using OCR of seven Indian languages as Indian language text cannot be extracted from digitally generated PDF, Text extraction from PDF containing scanned document images using OCR, production-ready web service of OCR Engine with Payload Encryption and SSL for PAN/UIDAI Number.

ISARA - Indian Sign lAnguage gRammar companion for learning

C-DAC has worked on development of standalone (WPF), web based (Bootstrap) and Mobile (Android) version of different domains, namely Daily Usage, Weather and Climate, Tour and Travels, Culture and Festival, Law Enforcement, Geography, Animals, Civics, Transport, Food and Cuisine. For this, corpus creation of different signs and symbols based on parts of speech from grammar namely nouns, verbs, adjectives etc. for normal and specially-abled students has been completed and incorporated. The E-Learning Software is based on parts of speech from grammar for English and Bengali and the contents are based on text, signs and symbols. Facility to download a standalone (offline) version of the software from the Downloads section of this website for both Desktop/Laptop (Windows) and Mobile/Tablets (Android).

DISAAA: Integrated Solution for Automatic Assessment of Autism

C-DAC has developed a standalone version for considering registration for an ASD child, Autism Screening Questionnaire module for screening of the ASD child, Digital ISAA module developed for creation of a digital version as part of manual entry done presently based on Indian Scale of Autism Assessment, Calibration of the hardware components to capture Eye movement, Attention and Facial Expression with the help of eye tracker and web cam, design and development of stimulus to capture response and development of data collection framework from ASD children using Visual Attention, Facial Expression and Vocal emotion cues.



DISAAA

Digital Preservation and Heritage Computing

Digitization of Manuscript including Repository and Retrieval System

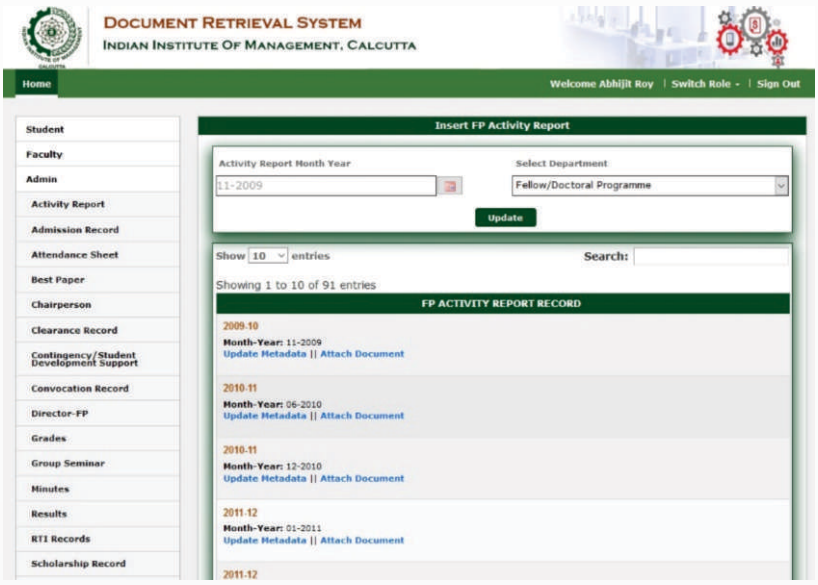
Digitization of 25,000 Folios of manuscripts available at Acharya Jogesh Chandra Purakriti Bhaban (District Museum) Bishnupur, Bankura, West Bengal. Also, a search engine for manuscript was developed.

Indo-Bhutan e-Library

The e-Library project has established an e-library network across Bhutan with underlying Digital framework for providing online and offline e-contents at 49 Schools and 12 Colleges. A central repository for storing and retrieving Digital contents and a content studio to regularly create digital contents as per local needs have also been established under the project. Major Outcome include e-Libraries at 49 Schools and 12 Colleges, Central content repository and Content creation Studio.

Digitization of Old Records including Repository & Retrieval System

Digitization of student records comprising 6 lakhs pages was completed by C-DAC. The software of PGP and FP Department's record management comprising of 30 modules was deployed along with online training of software.



Document Retrieval System

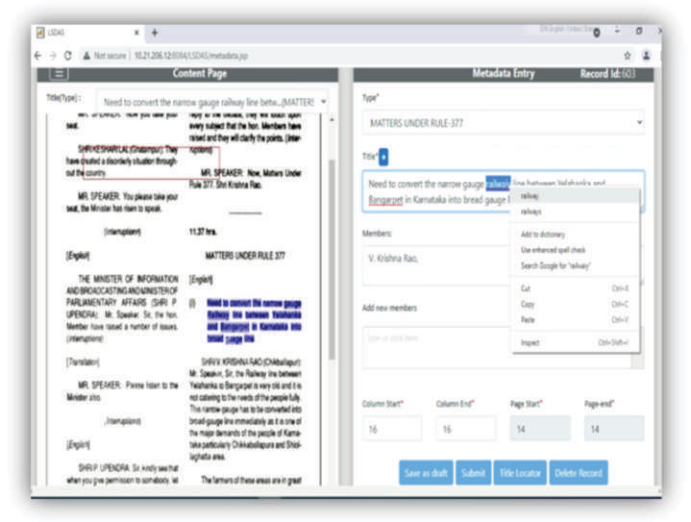
Web-based Integrated Information Management and Digitization System

C-DAC has developed and deployed web-based Integrated Information Management System having Daily Notes, Wiki for marked profile, Stock & Inventory Control System and Web-based Asset Management System. Phase-wise training of the software to the concerned officials was conducted.

Web-based Integrated Information Management System

AI Based Framework for rapid Digitization of Lok Sabha Debates

The development work intends to create software framework and necessary technology for creating an environment to facilitate faster entry of metadata for Lok Sabha debates pertaining to part 1 and part 2 debates. This is to cater to the needs of variations present in First to Tenth Lok Sabha debates by combining various AI based Document Image Analysis techniques to provide essential heuristics for indexing. This includes document image understanding, identification of Region of Interest (ROI), and extraction of Zonal features and DNN based architectures for the easy generation of metadata content of the Lok Sabha debates. Content page parsing, AI based Region of Interest (ROI) Detector, Automatic member name highlight and Automatic data export in compatible format were completed during the year.



Smart Museum

The overall concept is to create an innovative, holistic, and unified platform for India's Heritage which is coined as INternet of HERItage Things (INHERIT). The platform aims to facilitate key deliverables like Visitor Activity Tracking System (VATS), Antiquity Tracking System (ATS) variants (Environmental Parameters Monitoring and Artefact Physical Location Tracking) and the Interactive Museum Exhibit (IME).

Professional Electronics, VLSI, Embedded Systems and Quantum Computing

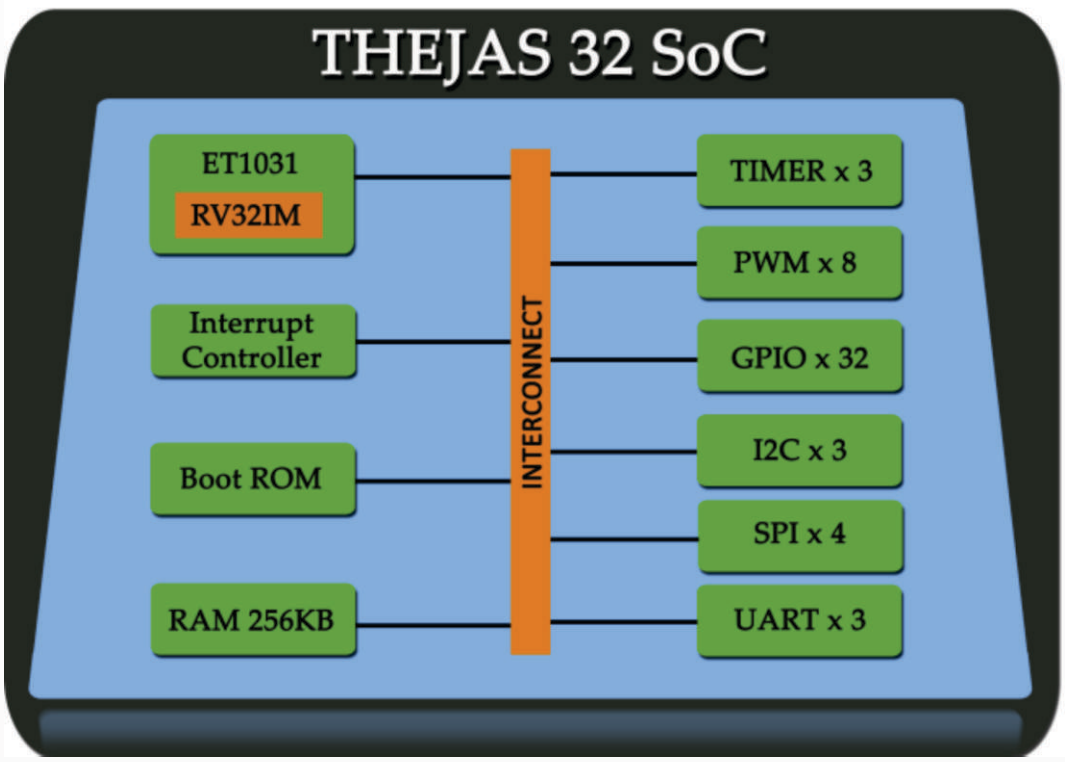
C-DAC's expertise in Professional Electronics, VLSI, and Embedded Systems broadly ranges from compact chip design to complex system design. The practical knowledge gained over the years in design, development, and implementation of IP Cores and IP Cores based VLSI Systems, microcontroller/microprocessor-based Embedded Systems, mixed-signal processing systems, and new-gen technologies like IoT and WSN has enabled C-DAC to idealize and execute various national initiatives. The key focus areas under Professional Electronics, VLSI, and Embedded Systems cover Intelligent Transportation, Security and Surveillance, Strategic Electronics, Power Electronics, Smart City & IoT Applications, Automotive Electronics and Agricultural Electronics. Activities in Quantum Computing includes QSim – Quantum Simulator, Centre for Excellence in Quantum Technology and Metro Area Quantum Access Network (MAQAN).

Projects of National Importance

Microprocessor Development Programme (MDP)

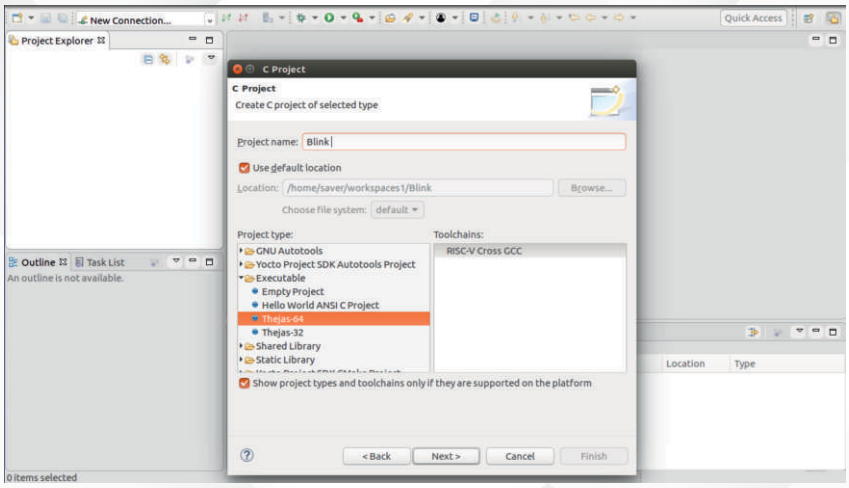
Microprocessor Development Programme, a programme of national importance funded by the Ministry of Electronics and Information Technology (MeitY), Govt. of India aims to achieve self-reliance in Microprocessor Technology. A two-phased execution strategy formulated under this programme targets design of an indigenous 64-bit Quad-core Microprocessor and implementation on an FPGA platform in the first phase and a 64-bit Quad-core Microprocessor-based SoC ASIC for Embedded Application in the second phase. The first phase concluded with the Linux Bootable VEGA Processor Series (IP cores) comprising five processors spanning from VEGA ET1031, a 32-bit processor to VEGA AS4161, a 64-bit quad-core processor. 'Swadeshi Microprocessor Challenge', launched by MeitY to popularize the VEGA Series, has been a success with many participating teams including start-ups designing with VEGA ET1031 and VEGA AS1061 microprocessors.

The first VEGA microprocessor-based SoC chip 'THEJAS32' is being fabricated in 130nm process technology and 'THEJAS64' 64-bit SoC chip has been taped out to the Indian foundry SCL, Chandigarh.



THEJAS32 SoC Block Diagram

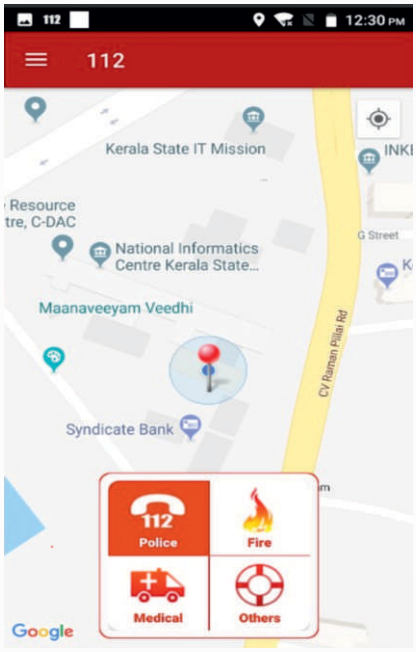
The release of Eclipse-based Integrated Development Environment (IDE) for bare metal programming and Linux application development will enable ease of use of VEGA. Nationwide certificate programme on Swadeshi Processors (VEGA Processors) has been launched jointly with NIELIT.



Eclipse based IDE for VEGA Processors

Emergency Response Support System (ERSS)

The Ministry of Home Affairs, Govt of India, has initiated a PAN-India single number (112) based emergency response system to address all kinds of distress calls under the 'Emergency Response Support System (ERSS)' project. Distress signals in the form of voice call to 112, email to 112, panic button activated calls to 112, Social Media alert to 112, and SoS messages to 112 are received centrally at State Emergency Response Centre (SERC). SERC processes these requests and forward them to support services (police, fire, health, disaster management, and railways) to render required services to the user.



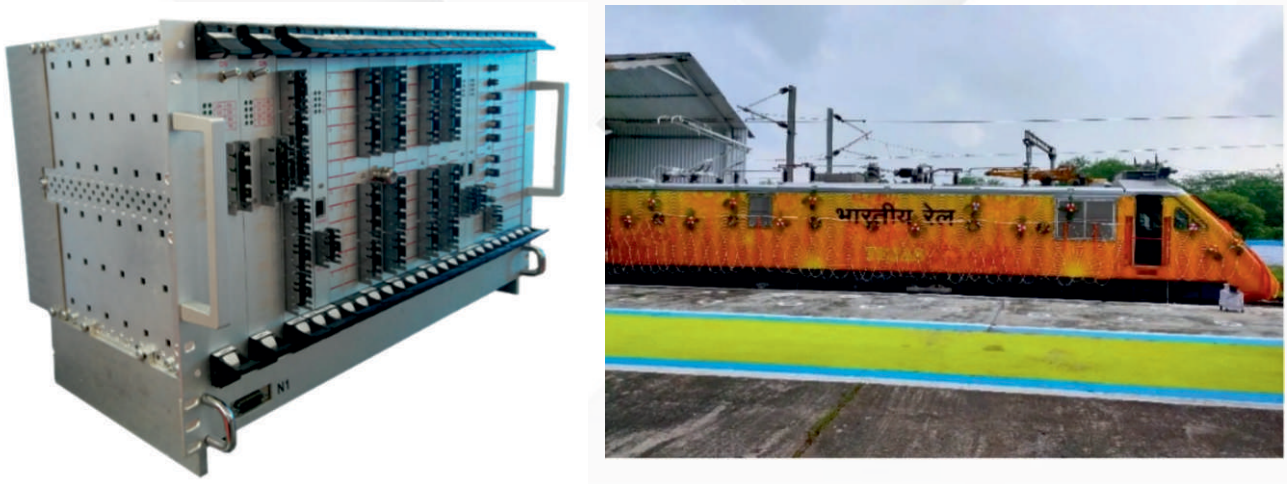
'112 India' Mobile App

The scalable and robust architecture of the Emergency Response Support System integrates GIS maps, tracking/navigation, GIS data analysis, image/video transmission, Inter-State / UT information exchange, tracing of records for victims/ crimes, etc. ERSS also facilitates GIS map-based real-time missions monitoring and ensures service unit's accountability. The shout facility of the '112 India' mobile app enables the user to seek emergency help from neighbouring first responders even before the emergency services arrive. ERSS is continuing its successful journey with 26 States and 8 Union Territories on board, seamlessly delivering emergency services to citizens.

National Mission on Power Electronics Technology (NaMPET-Phase-III)

C-DAC is the Nodal Centre for coordinating the activities of NaMPET and is fully involved in Phase III activities concurrently transferring technologies developed in NaMPET Phase I and NaMPET Phase II.

Vehicle Control Unit (VCU) is a digital controller for measuring, sequencing, control, regulation, protection, supervision, and communication tasks of electric locomotives. The technology transferred to five manufacturers has equipped more than 800 locomotives for freight and passenger applications. Chittaranjan Locomotive Works (CLW) manufactured Tejas Express locos for 'push-pull' operations with aerodynamically designed WAP-5 passenger electric locomotives using C-DAC's Vehicle Control Unit is the latest among them.



Vehicle Control Unit (left), Tejas Loco (Right)

Low Voltage Direct Current (LVDC) distribution is an innovative technology that improves energy access and efficiency. LVDC technology significantly reduces power losses occurring during renewable sources DC energy conversion to commonly used AC energy. The technology, Low Voltage Direct Current (LVDC) Powering architecture for Houseboat appliances deployed in collaboration with the Energy Management Centre (EMC), Govt. of Kerala, was launched by Shri. M. M. Mani, Minister for Electricity, Govt. of Kerala on February 17, 2021 at Alappuzha, Kerala.

LVDC powered Houseboat (left), Flexible Solar Panels on rooftop (Right)

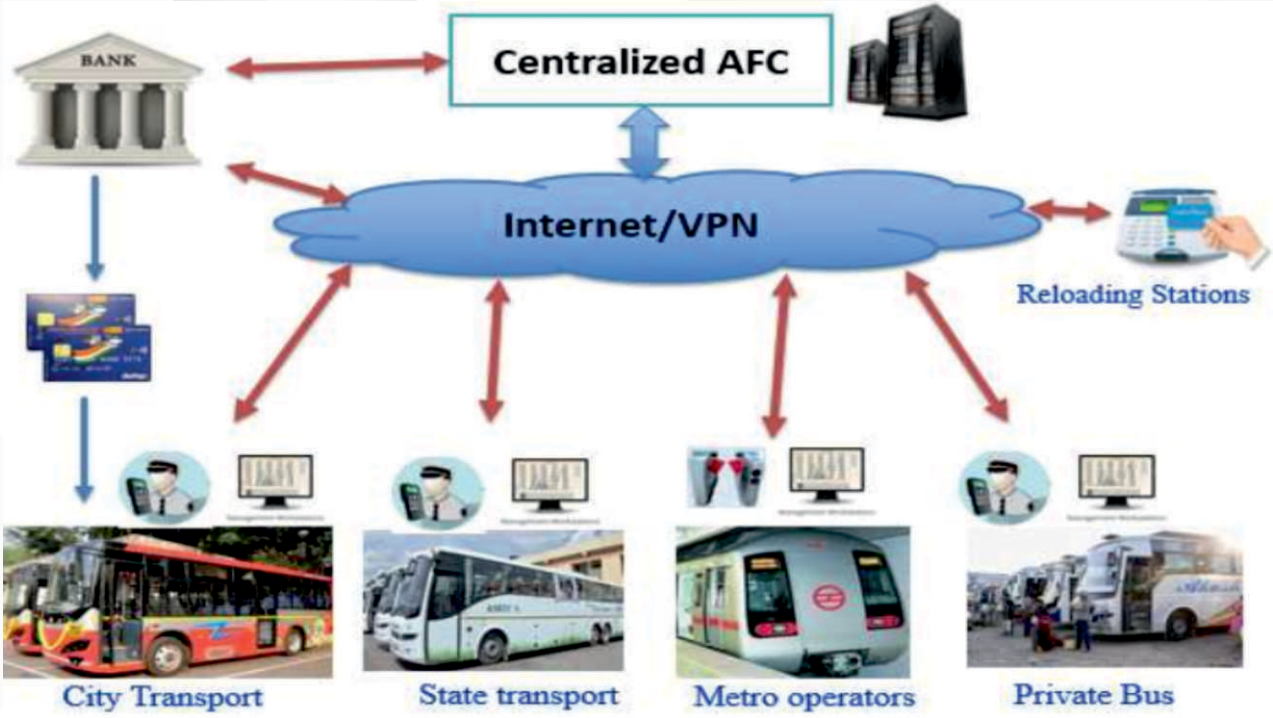
Intelligent Transportation Applications

Software for Transit Applications

National Common Mobility Card (NCMC) Compliant Centralized Automatic Fare Collection (AFC) Eco-System for Transit Operators, a sequel to C-DAC's prestigious project 'Sweekar' (Swachalit Kiraya: Automatic Fare Collection System) of NCMC Ecosystem, provides an integrated transit ticketing solution using NCMC, Cash & Paper-QR fare media.

The Centralized AFC system developed, maintained, and hosted by C-DAC in C-DAC's Data Centre enables the transit operators to implement the automatic fare collection system with low capital expenditure and operating

expenses. NCMC Compliant Centralized AFC Eco-System for Transit Operators is under field trial deployment at Wadala and Colaba Depots of the country's largest Bus operator, The Brihanmumbai Electric Supply & Transport Undertaking (BEST) of the Brihanmumbai Mahanagarpalika.



NCMC Compliant Centralized AFC Eco-System for Transit Operators

QR Ticketing System for Transit Applications is an indigenous solution designed to replace tokens in Metro rails and paper tickets in Buses. The system enables the authorities to generate QR tickets for passengers without NCMC. Currently, the system caters to Urban Transport operators. The deployment and field trials were initiated in collaboration with The Brihanmumbai Electric Supply & Transport Undertaking (BEST) and Bangalore Metro Rail Corporation Limited (BMRCL).

Adaptive Traffic Control System (ATCS)

Adaptive Traffic Control System (ATCS) adapts to real-time traffic patterns to optimize the traffic movement by dynamically adjusting the green light timings based on the traffic demand at the intersection and anticipated arrivals from nearby and downstream junctions. ATCS reduces travel time with fewer stops and less waiting time, facilitating a smoother flow by reduced congestions. C-DAC, in collaboration with the Directorate of Urban Land Transport (DULT), Hubballi-Dharwad Bus Rapid Transit System Company (HD-BRTSCo), commissioned the Adaptive Traffic Signalling System at 32 junctions and 2 pedestrian midblock crossings in Hubli-Dharwad BRTS Corridor, Hubballi and ATCS Command Control Centre at Hubballi.

Automated Test Equipment for Space System Testing

Automated Test Equipment for Reaction Wheel Drive Assembly

Towards facilitation of three-axis attitude control of the spacecraft, reaction wheel drive assembly has been interfaced with reaction wheels. The Automated Test Equipment comprises a custom-made carrier board and PC-based software to generate commands to evaluate the Reaction wheel drive assembly. The carrier board integrates analogue, digital, frequency and other test channels into a complex reprogrammable platform. The ATE provides real-time plots of wheel speed, wheel current, torque and other test requirements as per the configuration given in the ATE software.

ATE hardware (left), Integrated ATE (Right)

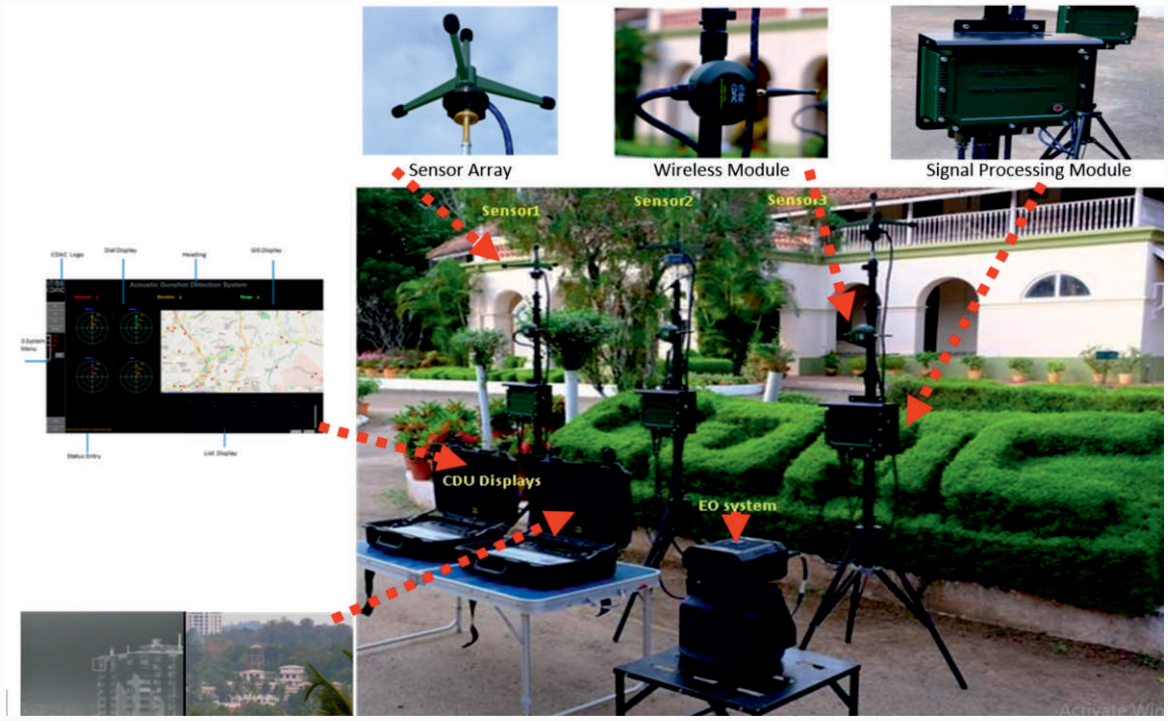
Automated Test Equipment for Inertial Reference Unit

Inertial Reference Unit (IRU) is an attitude sensing unit used in satellites. Automated Test Equipment for IRU is a test platform with custom-designed hardware and software to power, operate and generate commands to evaluate the subsystem performance, and safety interlocks. The complex ATE hardware integrates analogue channels, RMS measurement channels, digital channels, thermistor channels, and frequency measurement channels. The ATE software automatically generates test results in tabulated format.

Solutions for Strategic Sector

Acoustic Gunshot Detection System for Strategic Applications (AGDS)

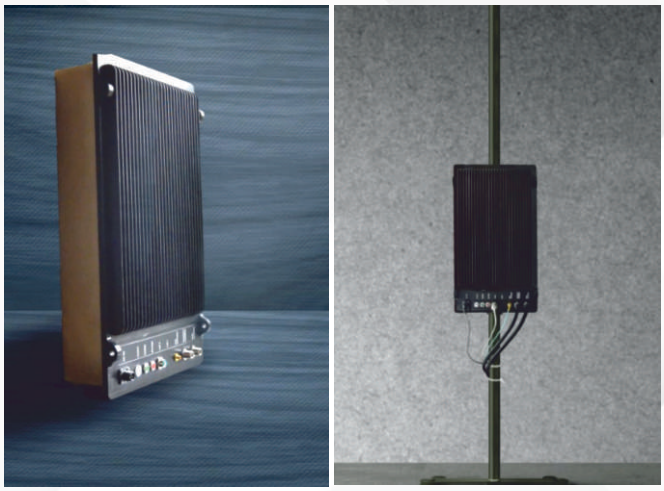
Acoustic Gunshot Detection System (AGDS) detects and conveys the location of gunfire using an array of acoustic sensors. The system promises a variety of field applications by the military, law enforcement, and security agencies to identify the direction of gunfire. The Stand-Alone Static configuration with networked sensors has been successfully developed and evaluated.



AGDS - Stand-Alone Static configuration with networked sensors

Micro TETRA Base Station

TErrestrial Trunked RAdio (TETRA) is a Digital Trunked Mobile Radio Standard developed to meet the needs of traditional Professional Mobile Radio (PMR) user organizations such as the Military, Government, etc. Micro TETRA Base station is a low-power, micro form factor base station suitable for indoor and outdoor deployments. The base station uses Multi-Carrier Power Amplifier (MCPA) technology and has a maximum transmission power capability of 6.3 W when run in single carrier mode. The technology has been transferred on November 27, 2020 to the identified partner.



Micro TETRA Base Station

Indigenous Doppler Velocity Log (IDVL)

Indigenous Doppler Velocity Log is a complex signal processing instrument to measure the velocity of ships or submarines in water using the 'Doppler Effect' occurring on acoustic signals due to the relative movement of transmitter/ receiver/medium. The technology has an extensive range of applications in Defence as well as in industries.

Ultrasonic Solid-Propellant Burn Rate Measurement System (USBRMS)

USBRMS system is an ultrasound technology-based system for measuring the burning rate of solid propellants. The system consists of an ultrasonic transducer, a pressure transducer, electronic unit, application software and a laptop. The system works on the principle of ultrasonic technique by repeated measurement of the thickness of a burning propellant specimen. The product has been deployed in various laboratories of key government agency and has successfully conducted more than 10,000 burning tests with 100% success rate.

Military Smart Card Operating System (MISCOS)

As an initiative of Ministry of Defence (MoD), C-DAC has designed Military Smart Card Operating System (MISCOS) that shall reside in secure microcontroller of the smart card used for authentication purpose in strategic sector. Under the initiative, MoD has established the MISCOS lab for design, development, testing & certification in-house with latest security standards. Key features shall include compliance to SCOSTA IS 16695 Part I and Part III with additional security components and Key Management System (KMS) for secured operations.

SOUNDS Mk2 R4 – ANSP

SOUNDS is a system for Non-Destructive testing and evaluation of materials, using Sonic and Ultrasonic frequencies. It enables measurement of velocity of a sonic-ultrasonic wave through the test specimen, and the attenuation of the wave in the material. It can be used for detecting internal flaws in test specimens, as well as for studying the characteristics of materials under test. SOUNDS Mk2-R4, the fourth model in the SOUNDS series, has features built in for use in NDT activities in explosive handling areas. This unit shall meet the safety requirements to get safety clearance for ultrasonic inspection of solid motor segments due to the explosive nature of solid propellants. This system is customized for NDT of Solid motor segments of Missiles.

Solutions for Agricultural Sector

Smart Hydroponic Controller

Hydroponics is a soil-less plant cultivation method using water as the medium to deliver nutrients, hydration, and oxygen. The Smart Hydroponic Controller monitors and controls the electrical conductivity, pH & temperature of the nutrient solution. The field trial conducted at Regional Horticultural Research & Training Station (RHRTS), Dhaulakuan (HP), ensured system scalability and ease of use.

Project site at RHRTS

Conveyorized CT-VIEU system for Dry Red Chillies

CT-VIEW is an innovative solution for rapid assessment of quality of dry chilli. The solution uses computer vision technology backed up by Artificial Intelligence technology for analysis of appearance-based quality parameters of chilli. Deployment of CT-VIEU system for Dry Red Chillies has been initiated at different Agri Produce Marketing Committees (APMCs) located in various districts of Telangana.

Industrial Control Systems

Testing Services for Industrial Control Systems (ICS)

C-DAC has developed an ICS security testbed for carrying out the testing of various automation systems. To meet the emerging testing needs coming from different industries, various test templates have been designed for ICS Security including, 13 Generalized functional test procedures and 7 Generalized security test procedures. Testing of 21 Fuel Dispensing Models for IOCL from various vendors and 7 Models for BPCL have been completed.

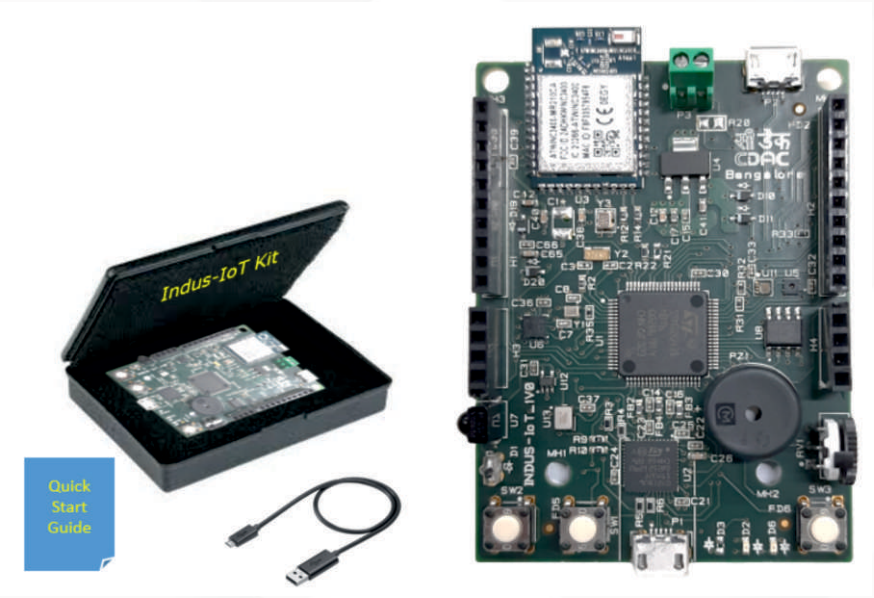
IEC 61850 based Substation Automation System

Digitized Substation is increasingly used as an essential building block for the development of Smart cities. These digitized substations are built around IEC 61850 Substation protocol to provide open, flexible and economic solutions for optimizing and increasing reliability and safety of protection and control architectures. In the initiative major components developed for realizing a digital substation are Merging Unit, Intelligent Electronic Devices, Substation SCADA and Cloud interface module. Merging Unit supports Three Phase measurement of Currents and Voltages, Analog Interface of CT/PTs, has Ethernet/Optical Interface and is targeted for use in Electric Substation and Switchyards. Substation SCADA supports configuration wizard which includes at-a-glance view of various modules. Pilot deployment of the system has been done in C-DAC Thiruvananthapuram 11KV Electrical Substation.

IoT Solutions

Indus-IoT (Innovation for Development and UpSkilling -Internet of Things) Kit

Indus-IoT (Innovation for Development and UpSkilling -Internet of Things) Kit is an ARM Cortex-M4 microcontroller-based feature-rich indigenous hardware platform for learning and development of Internet of Things applications. Key features of the kit include ARM Cortex-M4F based Microcontroller clocked up to 170 MHz, integrated hardware modules including FPU, ART Accelerator and DSP Instruction support, integrated Mathematical hardware accelerators for trigonometric functions and filters. Inbuilt memory is 32 KB SRAM and 128 KB Flash. The kit also supports various on-board sensors and actuators.



Indus IoT Kit

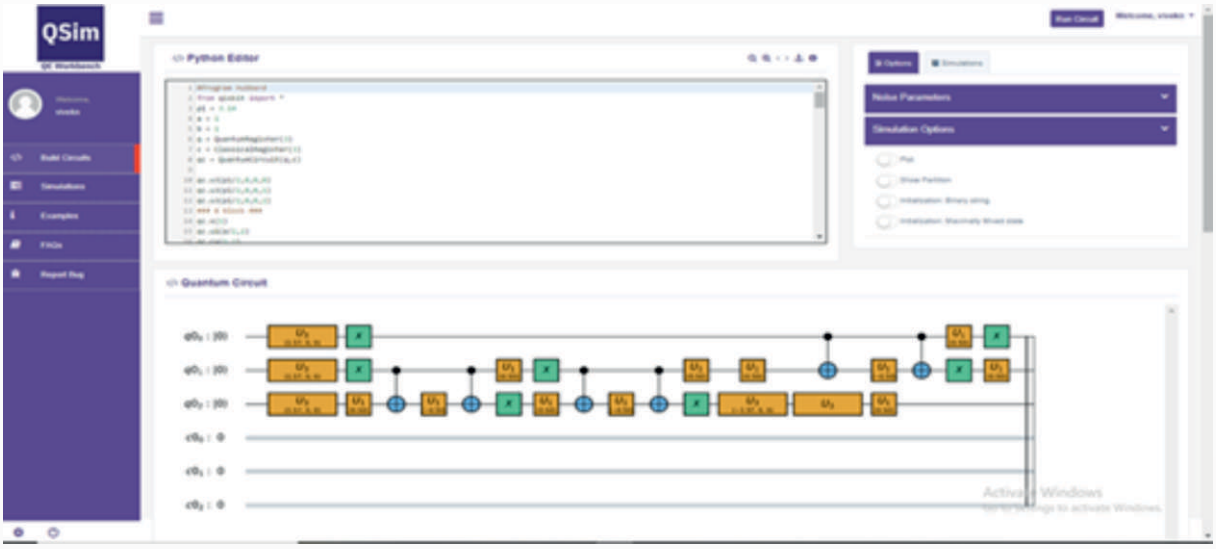
GLOWSENS – Global and local water quality monitoring by multimodal sensor system

C-DAC, in collaboration with Russia, Brazil, South Africa and China, is developing an affordable indigenous IoT solution in fisheries sector under the initiative of DST. The solution enables continuous monitoring of dissolved oxygen (DO), temperature and maintaining it with a certain level to reduce fish mortality in the cage culture. The system includes DO sensor interfaced with Rasberry PI board using USB, data acquisition using Modbus protocol, aerator control system for safe aquaculture and data transfer from the sensor node to the server using WiFi. The system has been deployed at CIFRI, Barrakpore.

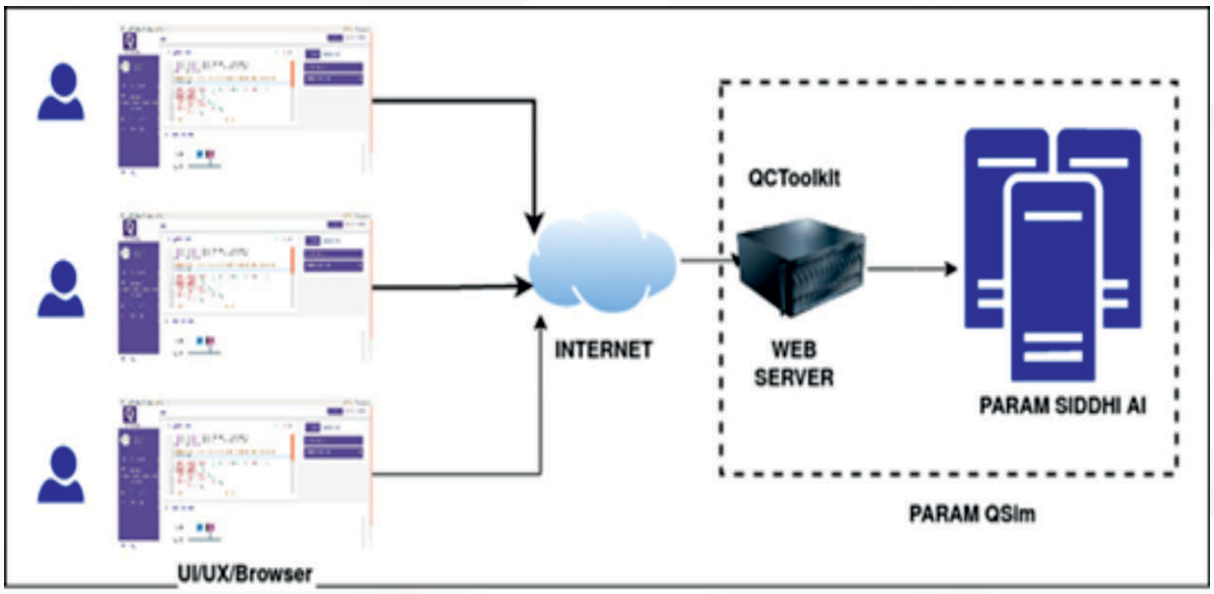
Quantum Computing

QSim – Quantum Computer Simulator Toolkit

QSim Toolkit enables researchers and students to do research in Quantum Computing. It allows writing and debugging Quantum code, essential for developing Quantum Algorithms. It provides a platform to simulate Quantum Circuits with and without noise and test how well various algorithms work with imperfect Quantum components. Quantum Simulations are performed on powerful HPC resources allowing multiple users to submit jobs simultaneously with different qubit configurations. Standalone system with 'Quantum Simulator in a box' is available on PARAM Shavak, while PARAM QSim Cloud is available on PARAM SIDDHI AI HPC infrastructure.



User Interface for Qsim



PARAM QSim Cloud

Centre for Excellence in Quantum Technology

The initiative aims to develop Quantum Technology in India, starting with construction and optimization of its elementary building blocks. The activity shall include development of Quantum Electronics for 4-qubit Quantum Processor in superconducting Transmon architecture. Key development components include FPGA based control and measurement hardware for characterization of a Quantum Computer test bed. The inbuilt RF-DAC will be used to generate custom signals which, after passing through the Quantum Testbed, will be captured over the RF-ADC and analysed. It is also aimed to develop a Python based software framework for real-time control and data acquisition from the FPGA based Quantum measurement hardware.

Metro Area Quantum Access Network (MAQAN)

The core objective of the MAQAN project is to experimentally demonstrate the concept of a 'Quantum Access Network': based on simple and cost-effective telecommunication technologies, the scheme can greatly expand the number of users in Quantum Networks and therefore vastly broaden their appeal. This project involves the development of the technology to broadcast photons over a wavelength division multiplexed fiber optic network, and show that a high-speed single-photon detector positioned at a network node can generate a secret key. This key can also be shared between multiple users for exchanging secret keys with the node, thereby significantly reducing the hardware requirements for each user added to the network. This point-to-multipoint architecture removes one of the main obstacles restricting the widespread application of Quantum Key Distribution (QKD). It presents a viable method for realizing multi-user QKD networks with efficient use of resources, and brings QKD closer to becoming a widespread technology. The core implementation will be demonstrated at Chennai with nodal points at IITM, SETS, ERNET and NIC. Further, experiments on the MAQAN Testbed will provide Security as a Service (SaaS) for strategic sectors.

Software Technologies including FOSS

C-DAC continued to carry out development and deployment of various software solutions in the areas of e-Governance, Free and Open-Source Software (FOSS), Social Development etc. under Software Technologies Including FOSS thematic area. Details of activities carried out by C-DAC during the year in this thematic area are mentioned below.

e-Governance

e- Governance Platforms and Frameworks

AUA-ASA and Aadhaar Data Vault

AUA-ASA along with Aadhaar data vault (ADV) is a REST API-based solution deployed for IOCL as per the compliance requirements of UIDAI data centre at Bengaluru and catering to the e-KYC and data vault requirements for IOCL applications which are deployed anywhere on the Indian Oil network. ADV is used for storing Aadhaar numbers encrypted using AES-256 key stored in the HSM. ADV and AUA-ASA provided to IOCL as a solution is seamlessly integrated with their applications using integration libraries provided by C-DAC. The ADV solution is heavily used by IOCL to decrypt the stored Aadhaar numbers for generating Direct Benefit Transfer for LPG Consumer (DBTL) subsidy payment advice.

eSangam: e-Governance Services Integration Framework

eSangam is a Service Oriented Architecture (SOA) based constellation of National and State eGovernance Service Delivery Gateways. C-DAC being the implementation agency, is also the Gateway Service Provider for MeitY, Govt. of India. The transaction count for various eSangam related services during the year was 2.81 crores and Total transaction count for various eSangam related services till March 31, 2021 was 26.54 crores.

Mobile Service Delivery Gateway Phase III

As part of government's m-Governance initiative, Mobile Seva centralized infrastructure platform was created by C-DAC for enabling Government departments to offer the public services through mobile devices. MSDG Phase III encompasses an extended Platform of Mobile Seva with the Mobile Service Delivery Gateway architecture and further enhancements. During the year, generic mobile applications including Geo-fencing based Attendance application, Complaint Management, Secure Chat, Smart Notification and Feedback etc. were developed and Distributor-Ledger Technology (DLT) blockchain based framework was implemented for commercial communication by TRAI for SMS services. 211 departments/agencies were integrated during the year and a total of 4055 departments/agencies have been integrated under this platform.

Mobile Seva AppStore-Revamping and National Rollout

Mobile Seva Appstore is nation's first indigenous App store, which hosts more than 970 live apps with more than 8.6 crore downloads of various domains and categories. The process of uploading and downloading of apps is penny less and hassle free. Only verified and signed APK files can be uploaded on the AppStore. C-DAC is engaged in National Rollout of the Appstore with all security features. ASR, SSO and Data Analytics will also be integrated with the platform.

e-Governance Standards and Guidelines

C-DAC in collaboration with the Standardisation Testing and Quality Certification (STQC) Directorate is engaged in an initiative for development/review of ICT Standards, guidelines and frameworks for effective and efficient implementation of e-Governance projects / Digital India Program. During the year, deliberations were carried out and various topics including IndEA 2.0, Online Learning and Examination System, Zero Trust Architecture, Anonymization of data, Mobile device security and IoT security have been identified for formulations of standards/guidelines. Various Committees / Working Groups (WG) and sub-groups for the identified topics have also been organized.

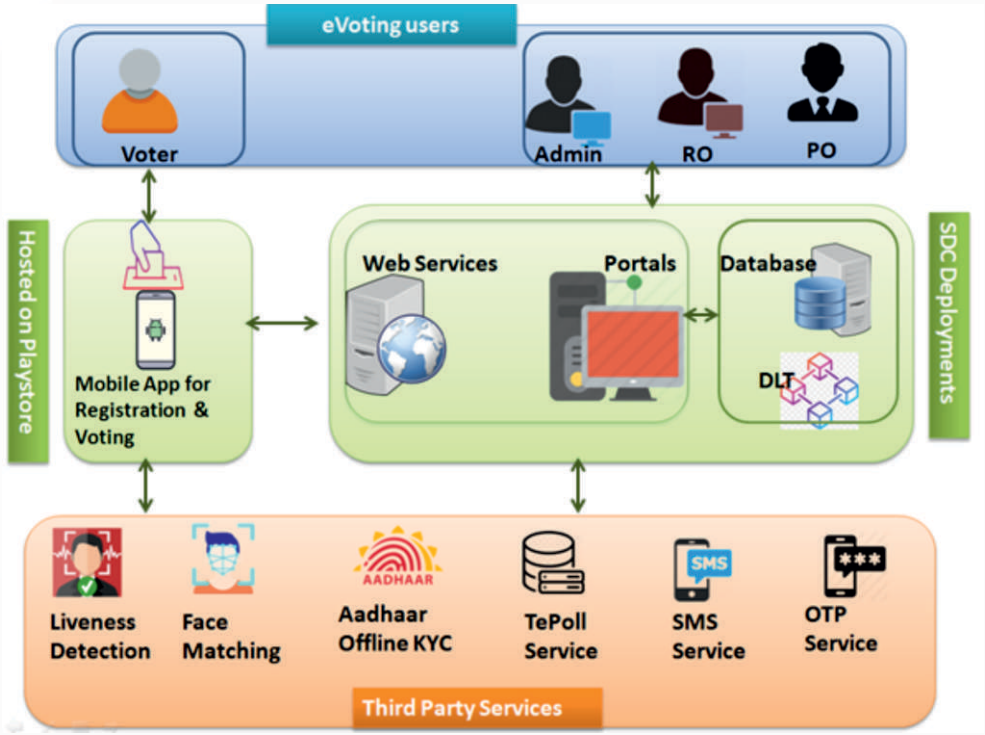
e-Governance Applications and Services

Unified Portal and Implementation of Government Schemes

Unified Portal application caters to the business needs of EPFO in providing timely service to its large number of stakeholders i.e., 120 offices across India, around 6 lakh active establishments filing monthly PF, Pension and EDLI remittances to the tune of Rs. 14,000 crores and for around 25 crore membership accounts. During the pandemic period, Government of India announced relief measures targeting the affected stakeholders. The Pradhan Mantri Gareeb Kalyan Yojana (PMGKY) scheme was notified as a part of the 1.7 lakh crore relief package announced by Govt. of India on March 26, 2020 to fight the pandemic. Through the online facility developed by C-DAC for EPFO, a total of 2.31 Cr provident fund advance claims were processed ever since the advent of the pandemic, and funds amounting to Rs. 44,374 Cr are being disbursed to the needy. To target any loss of employment during the pandemic, Government of India came out with Atma Nirbhar Bharat Rojgar Yojana (ABRY). The end-to-end implementation of these extremely important initiatives of Government of India was carried out by C-DAC in extremely tight schedule.

eVoting for Telangana State Election Commission

C-DAC developed first ever eVoting application for Telangana State Election Commission for Municipal Elections of Telangana districts. Mobile Voting / eVoting is a remote voting application which allows citizens / voters to vote from anywhere with the help of mobile device. An android based secure mobile app has been developed as part of client-side services for voter registration and voting through mobile. Polling officer portal, Admin portal, Returning Officer portal and backend webservices for mobile app have been developed as a part of server-side services. Other key features include PKI management, ensuring one voter casts only one vote, checking registration & voting window validity, limiting voting session transaction for security, separate attendance and vote transactions for voter privacy, protect vote tampering by maintaining hash, complete audit trails and traceability, Data security, immutability through Distributed Ledger Technology, etc.

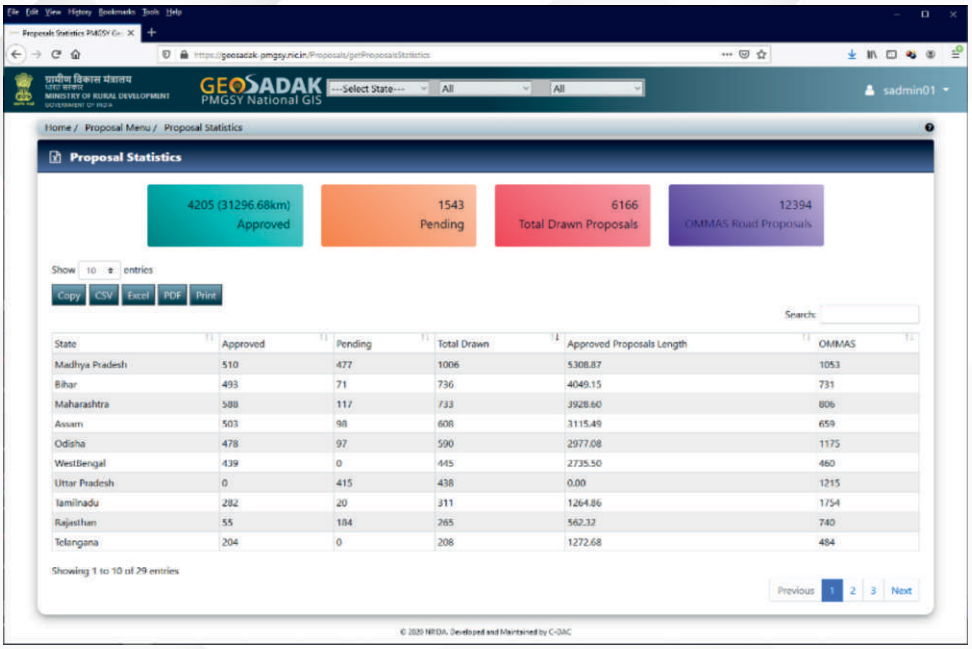


eVoting Application

GeoSadak

Pradhan Mantri Gram Sadak Yojana (PMGSY)-III envisages consolidation of the existing Rural Road Network. GeoSadak enables collating, managing, online spatial data quality report, editing and serving geospatial data in real time. It utilizes fully indigenous GIS data layers and satellite data services (ISRO Bhuvan, Open Street Map, etc) and is aligned with 'Atmanirbhar Bharat' initiative of Government of India. Key features implemented for Pradhan Mantri

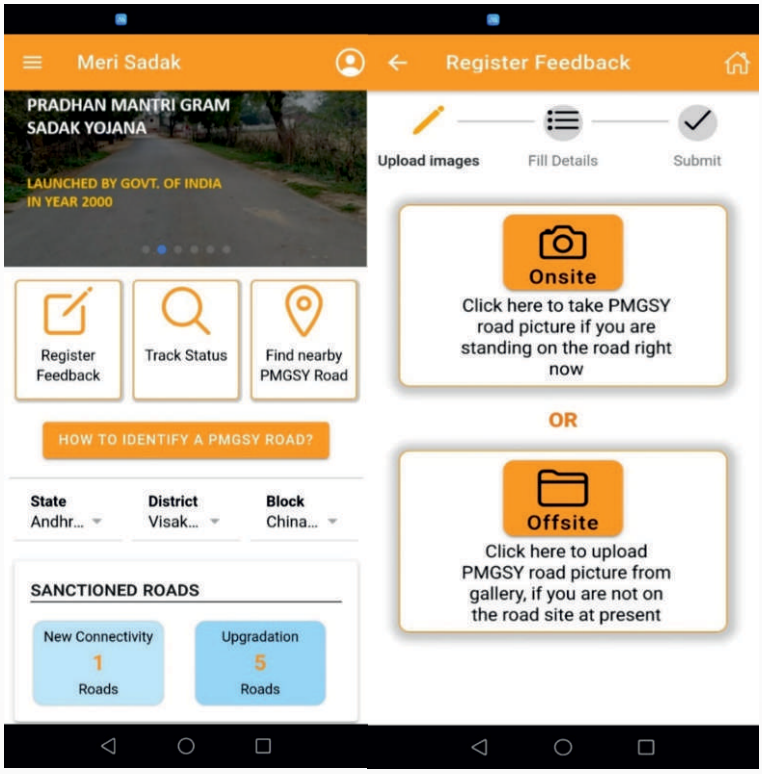
Gram Sadak Yojana (PMGSY)-III include simulation for road prioritization, shortest route analysis, Web API, online geospatial data upload/download, online geospatial data editing, data service based on Open Geospatial Consortium (OGC) standards, reports, user authentication, geospatial data analytics etc.



GeoSadak

Meri Sadak Mobile App for Pradhan Mantri Gram Sadak Yojana (PMGSY)

Meri Sadak application is part of the Government's Citizen Feedback system and is specifically meant for grievance redressal relating to roads built under Pradhan Mantri Gram Sadak Yojana (PMGSY). The application allows the citizens to register a complaint regarding the pace of work, quality of work, land disputes etc. for a PMGSY road along with photographs of the site. During the year, the mobile app was revamped to make it more user-friendly and introduce process reengineering for effective complaint handling.



Meri Sadak Mobile App

Long-Range Identification and Tracking System

Long-Range Identification and Tracking (LRIT) system provides global identification and tracking of ships. This consists of the ship borne LRIT Information Transmitting equipment, the Communication Service Provider(s), the Application Service Provider(s), the LRIT Data Centre(s), including any related Vessel Monitoring System(s), LRIT Data Distribution Plan and the International LRIT Data Exchange. The main purpose of LRIT is National and International Search & Rescue, Security and Environmental protection. The system has been deployed in LRIT National Data Centre in Directorate General of Shipping Premises and is currently in Operation and Maintenance Phase. The system updates as per directives given by International Maritime Organisation (IMO), went live successfully in April 2020 and DR Site at IMAC Gurugram went live in August 2020.

Integrated Financial Accounting System for Konkan Railways Corporation Ltd (KRCL)

C-DAC has designed and developed a comprehensive Integrated Financial Accounting System (IFAS) for KRCL based on accrual accounting principles. IFAS is work-flow enabled and is also tightly integrated with other related systems such as Stores inventory, Railway Traffic Accounting and Personnel Management System of KRCL to source relevant data and to build appropriate controls and validation checks for processing of transactions. System automates generation of various ledgers, reports and statutory schedules and also caters to various aspects pertaining to GST and IT taxation reporting, filing and reconciliation.

Software solution for RFID project for Indian Railways

C-DAC has developed a Free and Open Source based RFID middleware application for identifying the tags fitted to railway assets such as wagons, locomotives and coaches. It identifies, reads, parses and stores Electronic Product Code (EPC) data of tags. The solution also includes a Progressive Web Application (PWA) for assisting maintenance related operations using portable RFID readers. C-DAC is currently engaged in phase II of the solution involving development and stabilization of RFID middleware software for fixed readers and analysis of associated data.

JKPW-Online Management, Monitoring & Accounting System (JKPWDOMMAS)

JKPWDOMMAS is an online management and complete end to end solution for J&K Public Works Department. The application automates various manual processes of JKPWD including infrastructure management (road/building/bridge), online project proposal/estimation, tendering, project execution, quality control, safety and audit, asset maintenance, contractor management, human resource information system, billing and accounting, etc.

e-Seva Ladakh

C-DAC is developing of an e-Seva Ladakh portal which is a platform that contains workflow of 14 e-services and e-forms of various departments such as Agriculture, Health & Medical, Social Welfare, Industries and Commerce. The developed services will be integrated with the e-Taal, Digital–Seva Connect and Umang platforms.

Mumkin Scheme for UT of Jammu & Kashmir

C-DAC is engaged in Livelihood Generation Programme - 'Mumkin'- to provide financial assistance to the eligible youth of Jammu & Kashmir for establishing sustainable livelihood avenues. Eligible users will be able to avail the service online by filling the application form and will receive online approval from the department. Implementation of Online Mumkin Service will also provide the feature of monitoring the financial assistance given by the department to the beneficiaries.

Deduplication Engine Development and Deployment for Indian Navy's RFID Smart Card Project

C-DAC is engaged in Deduplication Engine Deployment based on Fingerprint Biometric for Indian Navy project of RFID-based Smart Cards. Deduplication Engine for Indian Navy's RFID project requires the SLA of 24 hours on a database of 1 million subjects. Deduplication Engine and Interface for its integration were tested and accepted at phase I of Smart Card Project of Indian Navy.

Centralized Attendance System based on Face Biometrics

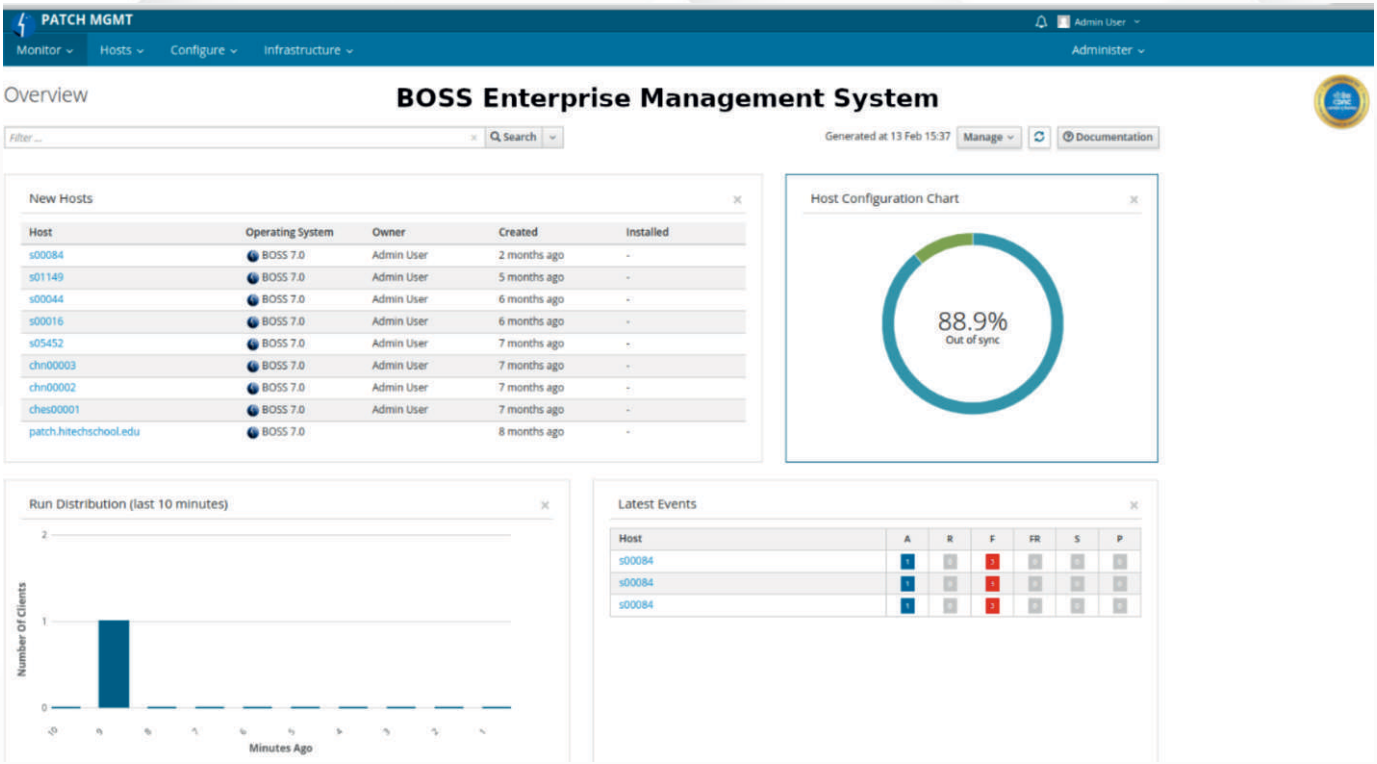
C-DAC developed a student attendance monitoring system funded by Directorate General of Shipping, Government of India using face biometrics. The system is common to around 125 maritime training institutes (MTIs). Key features

of the system include enrolment module for student registration, MIS and analytics module, online attendance monitoring, real time statistics (time, location, Institute) dashboard for successful and unsuccessful identification attempts, data security, centralized database as well as offline functioning, web-based portal to view attendance of all the colleges etc.

Free and Open Source Software Solutions (FOSS)

BOSS Enterprise Management Solution for DSSC

C-DAC has developed and deployed an Enterprise management suite to manage and monitor the BOSS Client machines in Defence Services Staff College (DSSC). Its key features include Domain Controller for User Authentication and Management, Network Authorization, Client log monitoring and management dashboard, alerts of Security Policy Violation, Policy and Patch management, Network Monitoring and Email Service etc.



BOSS Enterprise Management Solution

Secured BOSS OS

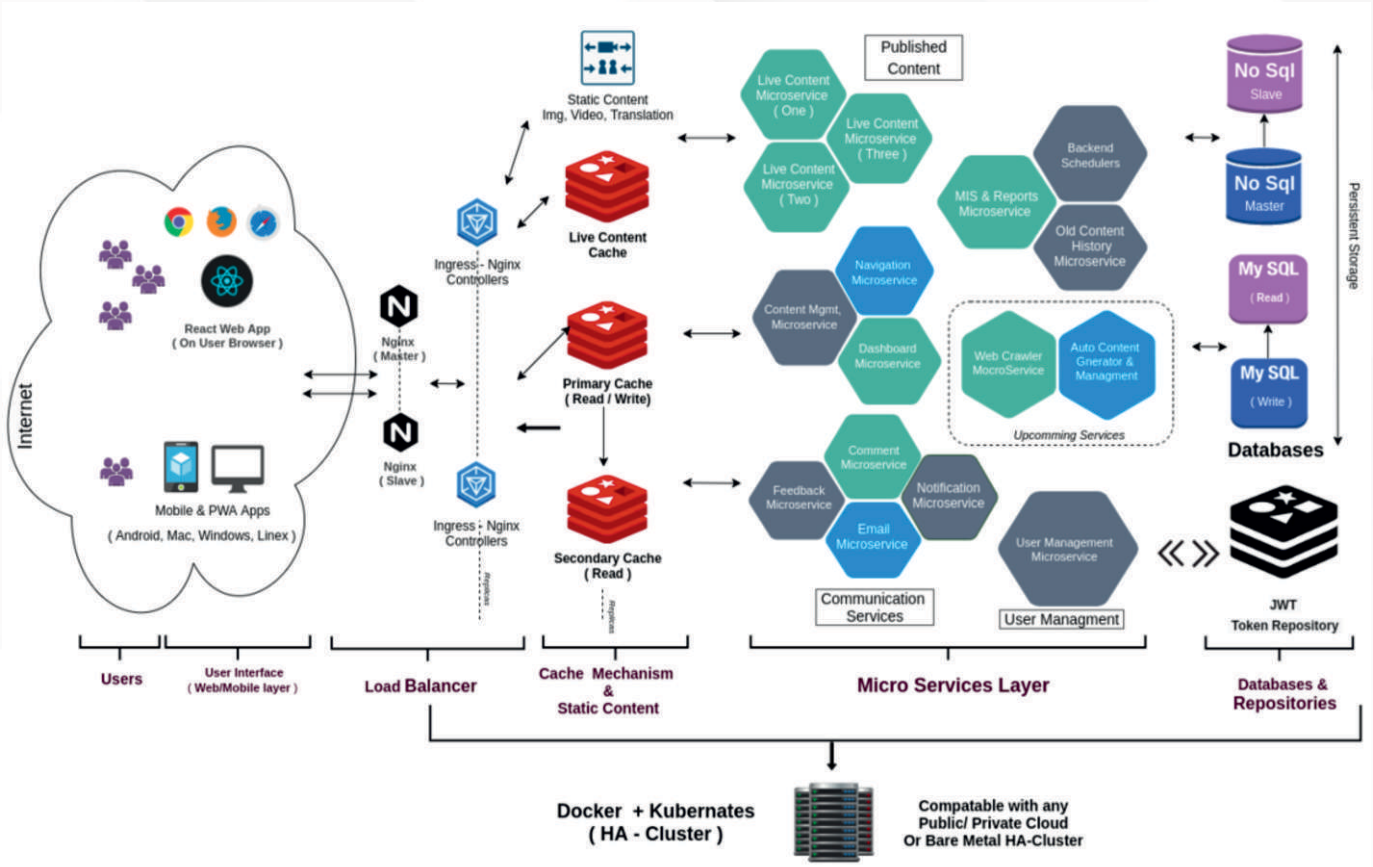
C-DAC customized Secure BOSS OS for Indian Army (version 2) and Strategic Forces Command (SFC) to be deployed pan India on their respective internet facing machines. The clients are pre-configured in compliance to Cyber Audit Policy. Key features include Disk encryption, integration with Log Management Server, Policy management server, Auto updating of patches and security updates, Blocking of external USB storage, Alert notification on remote access etc.

ICT for Social Development

Vikaspedia

Vikaspedia is a multilingual, multi-sectoral knowledge portal developed by C-DAC to empower poor and under-served communities through provision of information, products and services in all 22 scheduled languages of the country, besides English. Two additional thematic areas of "Aspirational districts" and a "Digital catalogue of government schemes" have been made available in the Vikaspedia Collaboration Knowledge Sharing Portal –

www.vikaspedia.in. During the year, 61 webinars were organized on Digital Content Access and Sharing in Indian languages for about 2,800 first level services providers from across the country in various languages. Two thematic outreach campaigns were taken up through Community Radio Stations to promote government programmes such as Atmanirbhar Bharat, PM Garib Kalyan Yojana, Covid awareness in the Aspirational districts and northern and north-eastern states of the country covering a population of about 1.7 Crore.



Vikaspedia Architecture

Knowledge and Resource Centre for Accessibility in ICT (KAI)

This initiative is to prepare the Indian Accessibility Standard for ICT along with BIS through its consultative process and to create nation-wide awareness. During the year, C-DAC studied various standards and prepared review report on customizing European standard EN 301 549 v2.1.2 along with India-specific Accessibility Requirements for ICT products and services based on consultations with drafting committee members. Accessibility Testing was carried out and compliance reports prepared for five ICT products from different categories such as website/portal, mobile app, software, hardware and products/systems involving both hardware and software. Stakeholder meetings were conducted for various sections including users, industry bodies, Government and software developers/implementers etc.

Solutions for Tracking

Transportation Software Suite, Vehicle Tracking and Fleet Management System

- C-DAC is developing a Transportation Software Suite for Kerala State Road Transport Corporation (KSRTC) that will include fleet and route management software along with Passenger Information System.
- C-DAC is engaged in the development of Vehicle Tracking and Fleet Management System (1) to enable Kerala State Civil Supplies Corporation to monitor the movement of vehicles which are used for the transportation of food commodities and (2) to enable Kerala Water Authority (KWA) to monitor the movement of vehicles which are used for the transportation of water to various locations.

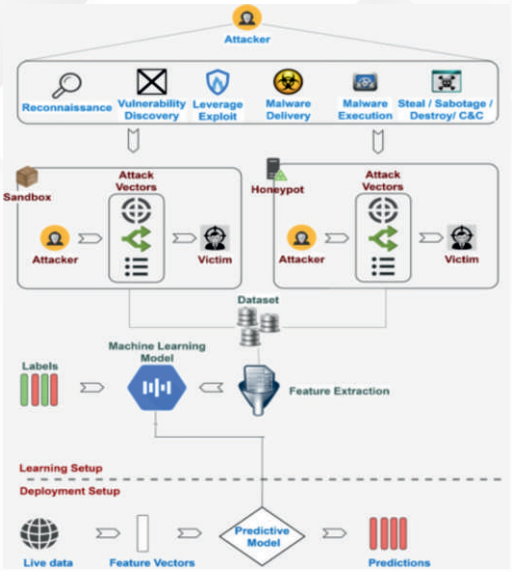
Cyber Security & Cyber Forensics

C-DAC continued its R&D in Cyber Security and Cyber Forensics developing various solutions related to detecting emails with malicious intentions, Multi-stage Attack Detection, advanced tools supporting Security Analysis of binaries, enhancements to Online Digital Signing facility & Cyber Forensics tools, Intelligent Security Analytics solution, Cyber Security virtual training facility and Blockchain based Cloud Security Assurance & Domicile Certificate Verification solutions. Other important activities include setting up State-of-the-art lab infrastructure, offering security services, conducting skilling programs and large-scale awareness generation across the country. Details of the significant achievements under this thematic area during the year are listed below:

Machine Learning and Program Analysis for Cyber Security

Multistage Attack Detection using Machine Learning

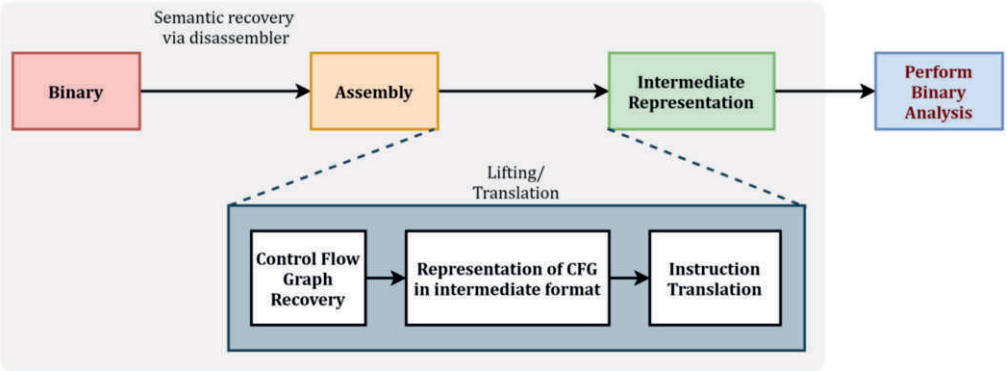
This solution leverages Machine Learning models to detect multistage attacks. Models are built for each stage of the cyber kill chain and the output of all the stages are correlated to get accurate results. Key features are Analysis of executable programs, static, dynamic & network analysis, visualize the attack and maps it to the MITRE ATT&CK Framework.



MITRE ATT&CK Framework

Decompiler for 32-bit MIPS

C-DAC developed translation tool(s) for translation of MIPS 32-bit Release 2 Version 1 binaries to LLVM (Low level virtual machine) Intermediate Representation (open-source compiler infrastructure for lifelong program analysis) IR (Intermediate Representation) for MIPS architecture. Two lift modes for different purposes a) for recompilation of the lifted code b) for symbolic analysis of the lifted code were also developed. This tool is useful for security researchers to carryout Binary Program Analysis.



MIPS architecture

Identity Access Management and PKI

e-Hastakshar – C-DAC's eSign Service

As part of Government's Digital India Initiative, C-DAC has developed e-Hastakshar – C-DAC's eSign service that facilitates instant signing of documents online by citizens in a legally acceptable form. Using this, an Aadhaar holder can electronically sign a form/document anytime, anywhere, using a device such as PC or Laptop or Mobile. Through e-Hastakshar, C-DAC offers hassle-free, fully paperless citizen services and convenience to users. C-DAC utilizes service of Unique Identification Authority of India (UIDAI) for on-line authentication and Aadhaar eKYC service. e-Hastakshar service supports both One Time Password (OTP) and Biometric (Fingerprint) based modes of authentication for leveraging eKYC service of UIDAI. During the year, C-DAC carried out integration with various government departments for leveraging e-Sign service at production level and more than 2.54 Lakhs e-Sign were issued till March 2021.

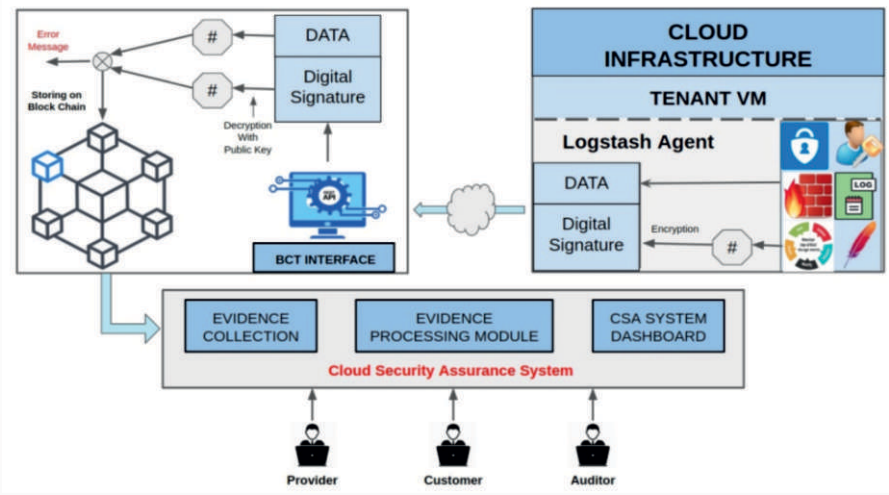
e-Pramaan: A National e-Authentication Service along with Aadhaar

e-Pramaan is a uniform standard based national e-authentication service developed by C-DAC to authenticate users of various Government services in a safe and secure manner for accessing services through desktop as well as mobile. It is integrated with PAN, Aadhaar and Driving License as identity providers. It provides various authentication mechanisms such as password based (Text, Image), OTP based (SMS, eMail, Mobile App), Digital Certificate (IndianCAs) based and Biometric (Fingerprint, Iris) based. Aadhaar Data Vault is developed as per UIDAI specifications and can be availed as service as well as solution. Another major component of e-Pramaan is Aadhaar Ecosystem. C-DAC is ASA – AUA/KUA of UIDAI to provide Aadhaar services and is compliant to UIDAI's latest API and specifications. During the year, 14 services were integrated and 3.4 crores transactions were completed as part of this initiative. A total of 271 services have been integrated and around 13.92 crores total transactions have been carried out using this platform.

Blockchain based Solutions

Cloud Security Assurance Framework using Blockchain

Cloud Security Assurance is enabled through a set of control-based technologies and policies adhering to Regulatory Compliances, rules for Protection of Application Data and Cloud Technology Infrastructure. Cloud Security Assurance ensures continuous monitoring of cloud data, resource utilization patterns and reports the incidents about security policy violations. Evidence collection related to security policy violations and preserving the same in tamper evident manner makes the process of Cloud Security Assurance a trustworthy effort for its stakeholders. Salient features include Evidence collection against security benchmarks, Tamper proof evidence storage on Blockchain, Periodic Auditing of Collection evidences, Anytime publicly available Audit Statement and Self-Assessment by the stake holders.



Cloud Security Assurance Framework

Proactive Threat Analysis

WebSIEM Tool

WebSIEM is a software solution that aggregates and analyses activity from many different resources across organization's entire IT infrastructure and collects security data from network devices, servers, domain controllers and more. Further it stores, normalizes, aggregates and applies analytics to that data to discover trends, detect threats, and enable organizations to investigate any alerts. Key Features include Intuitive Dashboard Visualization, Early Detection & Threat Hunting, Incident Triage and Advanced Behaviour Analysis using Threat Intelligence etc.

WebSIEM Dashboard

National Cyber Coordination Centre: Phase II

National Cyber Coordination Centre (NCCC) envisages setting up of a National Security Operations Centre to support analysing multi Million Events per Second (EPS). Key objective is in securing the cyber space by means of correlated analysis of cyber threats & attacks based on meta data aggregated from various sources including traffic data from selected services Providers, Threat alerts from security information, event management devices and operational logs/events. Towards the same, systems for analysing sustained EPS and to collect metadata from 18 locations including ISPs, State Data Centres and various organizations have been setup. It is being scaled up for Security Operations facility to collect data from many locations and to carryout analysis based on Internet traffic along with DNS logs and Border Gateway Protocol data.

DARPAN Data Centre Suite

DARPAN Data Centre Suite is a bundle of tools specifically designed for the management of Data Centres. Major features of the solution include Resource Discovery, Network Management, Server Management, Virtualization Platform Management, Application Management, Storage Management, Configuration Management, Inventory Management, Utility Management etc. It also supports management of datacentre related services such as service request, change management, configuration management etc. During the year, deployments were carried out for Madhya Pradesh State Wide Area Network and Kerala State Data Centre and Kerala State Wide Area Network.

SARAN Service Management Solution for Data Centre

SARAN Service Desk Management Software is customized for Data Centre Service Request Management with end user feedback and knowledge base management. During the year, the system was deployed at Kerala State Data Centre and Kerala State Wide Area Network.

SARAN Service Management Solution

Cyber Forensics

DIGIFAI Toolset

C-DAC has developed an AI based toolset for Cyber Forensics having three major components: (a) Machine Learning based text analytics (DIGITEXT) for analysing suicide notes considering various phyco-linguistic patterns and emotional tones; (b) DIGIDOC – Document forensics tool based on image processing; (c) DIGIMONITOR – for monitoring social media to identify violence and provoking activities in cyber space. Alfa version of the Toolset has been deployed at Digital Forensic Lab at BISCOMAUN Bhawan, Patna, Bihar.

Setting up Cyber Forensics Laboratory

C-DAC team is setting up Cyber Forensics Laboratory cum Training Laboratory in the State of Arunachal Pradesh. This Lab shall provide support in investigation of Cyber related crimes for the police personnel at all levels from first responder to professional cyber forensic analysts. Setting up of a state-of art training lab and Trained Cyber forensic manpower are the outcomes of this initiative.

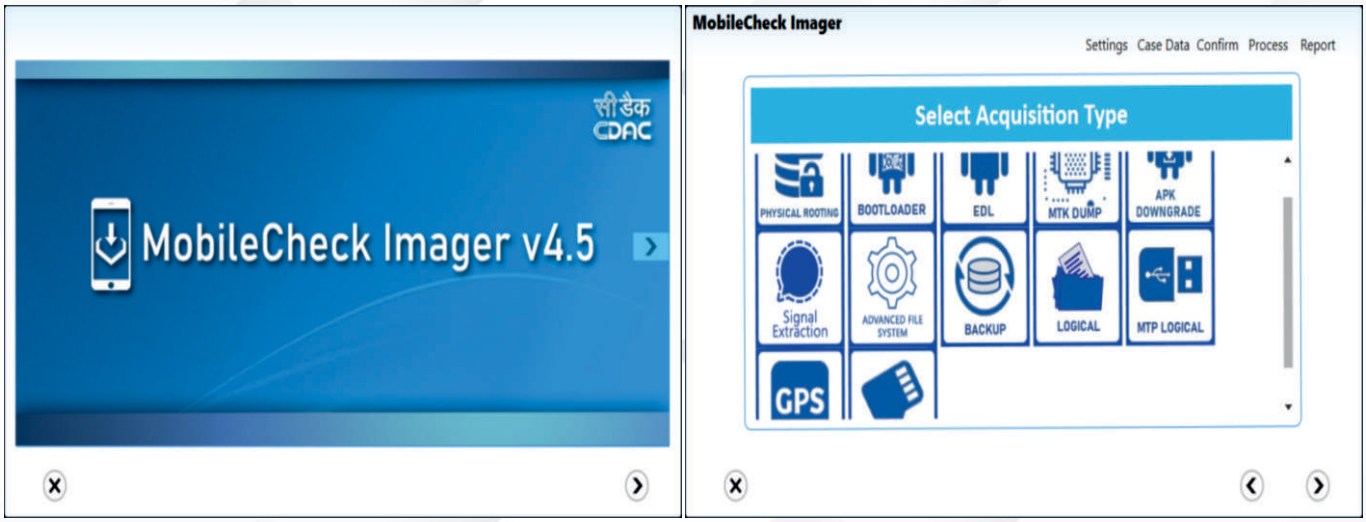
Cyber Forensics Suite

During the year, C-DAC upgraded the following Cyber Forensics Suites and deployed for various agencies.

CyberCheck 7.0 - CyberCheck 7.0 is a forensic data recovery and analysis tool which enables law enforcement officers to quickly and efficiently analyse images of hard disks, USB drives and other storage media. Same has been deployed for key agencies in Kerala and Andaman & Nicobar.

Win-LiFT 4.0 - Win-LiFT is a Windows Live Forensics Suite consisting of two Cyber Forensics tools, Win-LiFTImagerBuilder and Win-LiFTAnalyzer. Same has been deployed for key agencies in Bhopal, Thrissur, Andaman, Chennai, Damascus and Mumbai.

MobileCheck v4.5 - MobileCheck is a digital forensics solution for Basic phones, Feature Phones, Smart phones and GPS Devices. The solution supports acquisition, analysis and reporting of evidence from mobile devices. The major tools in the MobileCheck solution are Imager, Analyser and SmartPASSeR.



MobileCheck Forensic Solution

TrueImager 4.0 - TrueImager is a high speed, light weight, portable disk imaging hardware solution with battery backup support that is capable of performing hashing, imaging and cloning operations of source storage media. The same has been deployed for key agencies in India and abroad.

TrueImage 4.0

Services and Training

Cyber Security Architecture - Tamil Nadu

Cyber Security Architecture for Tamil Nadu, an initiative of Department of IT, Government of Tamil Nadu for security of e-governance, public data and infrastructure is being implemented by ELCOT in collaboration with C-DAC.

Security Audit and Assessment Services

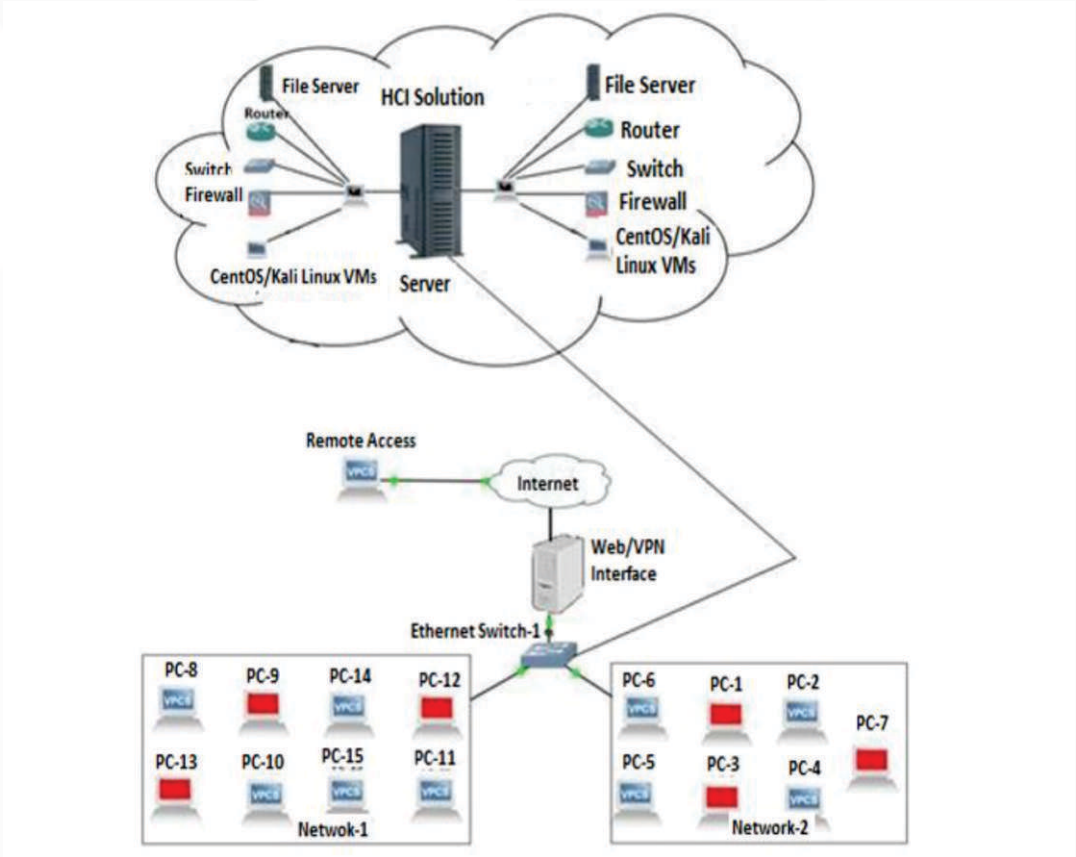
Being a Cert-In Empanelled Organization, C-DAC offers Security Audit & Assessment services like Vulnerability Assessment, penetration testing, regulatory compliance audits and so on. During this period, C-DAC audited and certified approximately, 435 applications / network infrastructures. C-DAC empanelled with SBI for carrying out Security Assessment of SBI Applications, Infrastructure and Operational Audits.

Information Security Education and Awareness (ISEA)

C-DAC team actively contributed towards Information Security Education Awareness (ISEA) activities through various awareness workshops, master trainer training, awareness weeks / months in various states, newsletters, DD / AIR programs, multimedia video & poster content, handbooks and so on. Received a certificate of National Records for training highest number of Teachers attended online training on Cyber Security awareness in the state of Telangana. Team organized month-long Awareness programs in Telangana and Andhra Pradesh. During the year, 68,251 candidates were trained in various formal/non-formal courses through 52 institutions. In addition to this, five Technical Universities have trained/undergoing training around 2.74 lakh candidates in formal courses in their respective affiliated colleges. More than 950 technical papers have been published by 52 institutions in the area Information Security. 16,310 Government personnel have been trained in various short-term courses on direct/ e-learning/VILT mode in Information Security.

Cyber CLOSET: Virtual Training Facility

C-DAC has setup a multipurpose real, live simulation platform for training Information Security professionals under Cyber CLOSET initiative. This cyber security platform helps to recreate the experience of responding to a cyber-attack by replicating the organizational network environment and the attack itself. As a result, it enables hands-on training in a controlled and secure environment. Hence, Cyber CLOSET training provides an extended level of freedom for executing any type of attack in the virtual environment. This facility has been implemented using Hyper Converged Infrastructure (HCI) technology with Cloud and SDN features.



Cyber CLOSET Architecture

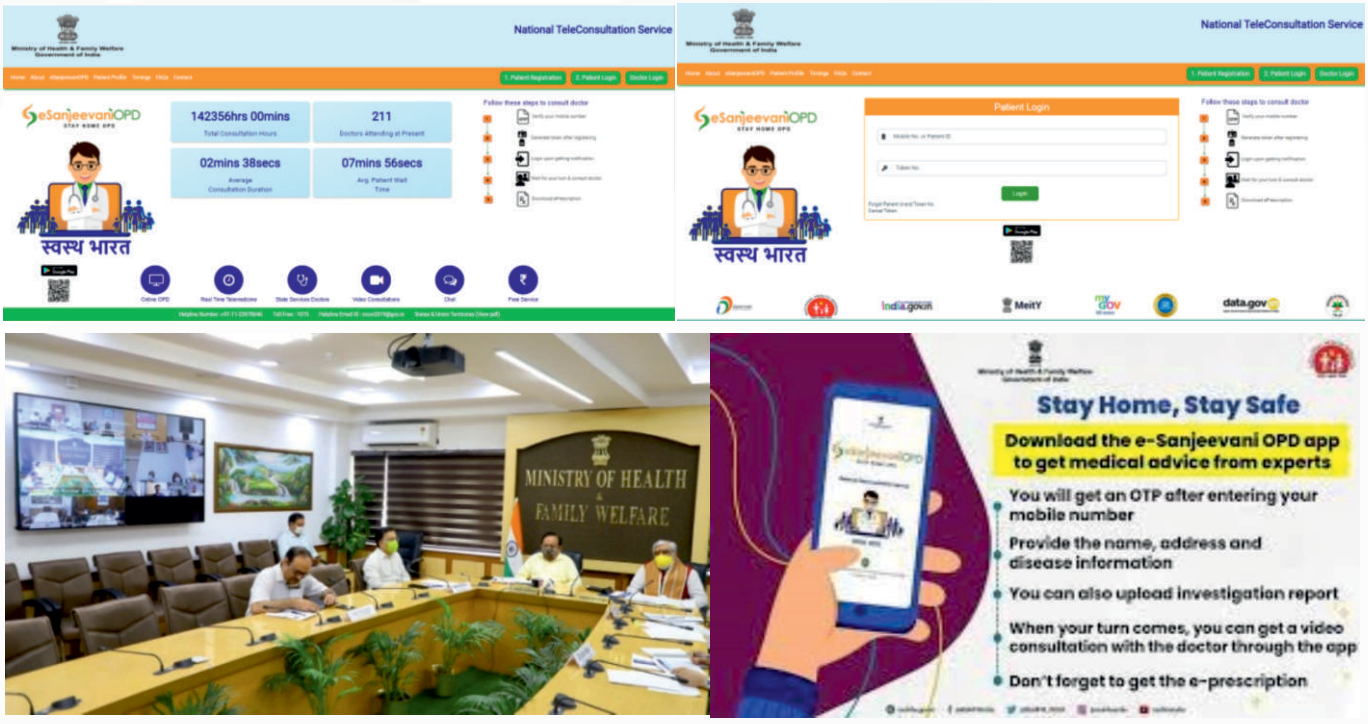
Health Informatics

Health Informatics comprises of activities related to Healthcare Solutions, Research, Health Information Systems and Healthcare Standards. Health Technologies have played a vital role during the Covid pandemic. People have realized the strengths of these technologies which have been widely used to save many lives. C-DAC's Health Informatics Solutions and Research has contributed immensely to achieve the goals of making affordable and quality healthcare accessible to the people. The key focus areas under Health Informatics cover C-DAC Telemedicine Solutions, Hospital Management Information System (HMIS), Drug and Vaccine Distribution Management System (DVDMS), Blood Bank Management System (BBMS), Radiation Treatment Planning System, Health Standards Tool Kits and Applications. Various activities carried out by C-DAC during this year in this thematic area are briefly described below.

Healthcare Solutions

eSanjeevaniOPD (Patient to Doctor Telemedicine)

C-DAC's eSanjeevaniOPD is basically a patient to doctor tele-consultation system which is operational since April 2020. Developed for MoHFW for providing teleconsultation services to patients through safe and structured video-based clinical consultations between doctors in a hospital and patients in the confines of their home (an ideal solution for the COVID-19 pandemic situation). Over 30,00,000 patients have been served through eSanjeevaniOPD. More than 18,000 doctors from 34 States were trained and on-boarded by C-DAC during the year.



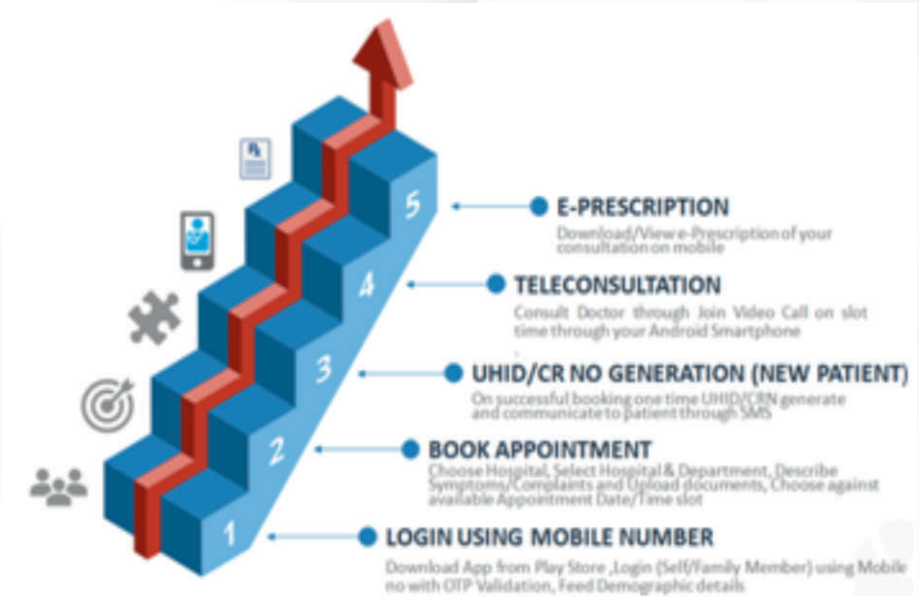
eSanjeevaniOPD

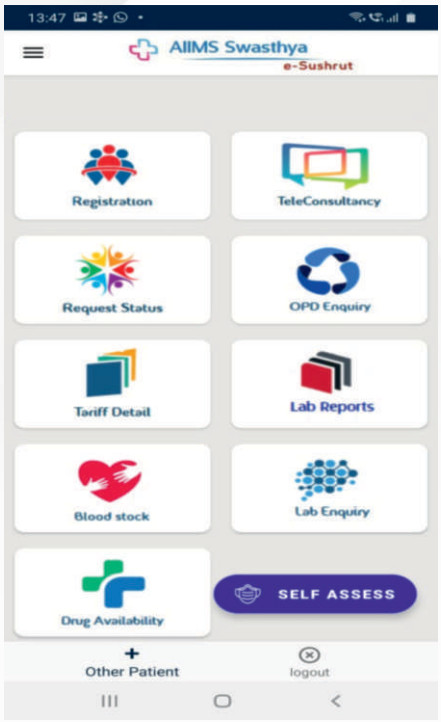
Teleconsultation Software for Tri Services (SeHAT)

SeHAT is web-based telemedicine technology with in-built video conferencing for personnel (and their dependents) serving in three services of Armed Forces of India. It is under development for Ministry of Defence, Govt of India. In rising era of Covid-19 pandemic, there exists a need to develop a telemedicine platform for the doctors of three services (Armed Forces) so that they can seamlessly and remotely connect in real-time to their patients through the internet and available Laptop/PC/Mobile. SeHATOPD will enable risk free, contactless and safe consultations with doctors. It will help patients to get health services in the confines of their homes. More than 7,580 patients have already been served through SeHATOPD's POC that is functional since May 2020. More than 6,70 doctors (AFMS) have been trained and on-boarded by C-DAC.

m-Consultation Mobile App: e-Sushrut mConsultation

e-Sushrut mConsultation is a highly robust, flexible, scalable audio- video consultation platform. Due to the COVID-19 pandemic, patients, health workers and doctors are facing challenges in treatment /consultations through routine OPDs. Based on the need of the hour, C-DAC has developed a mobile-based m-Consultation solution which could easily be configured for any hospital. This facilitates patients to easily connect with doctors using mobiles/tablets for medical video/audio consultancy and follow up. The app features appointment-based consultations with audio/video calling and chat, push notifications and Electronic Health Record compliant prescriptions. The e-Prescription generated by the consultant can be easily shared to the patient through secure infrastructure. The generic design of the solution allows for onboarding multiple hospitals for increasing access for patients.





e-Sushrut mConsultation

Telemedicine Network for NTPC (Phase II)

C-DAC has established Telemedicine Network for NTPC Limited under Phase-1 of this project. NTPC is now planning to expand its Telemedicine Network as Phase II by adding more RTCs into the existing network for the delivery of specialist services through Mercury™ Nimbus at many remote locations.

Mobile Telemedicine System for Tribal Care-Wayanad Phase II [MTSTC Phase II]

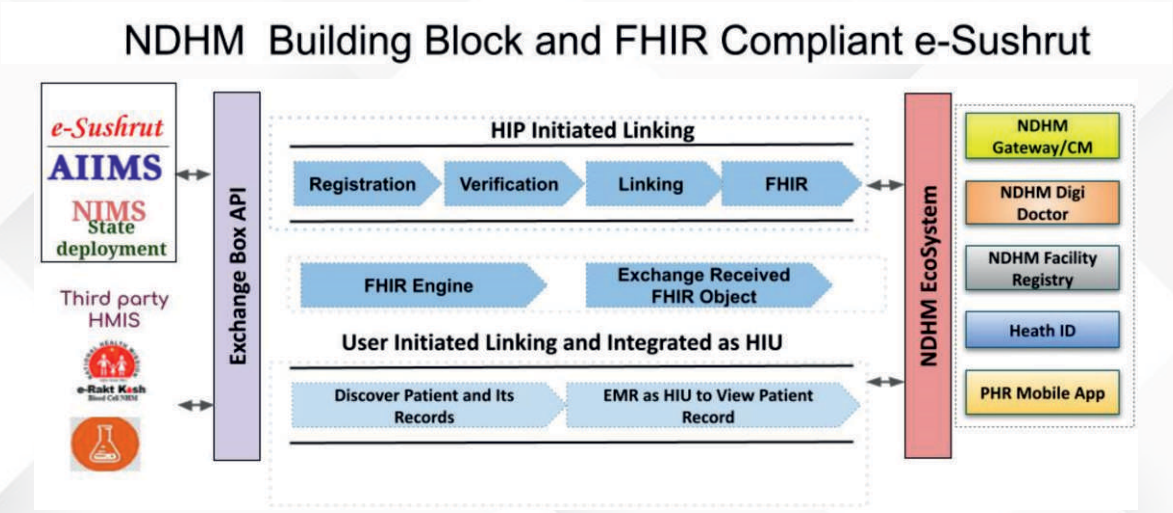
The objective of the project is to enhance the Mobile Telemedicine System for Tribal Care Wayanad with additional software modules and additional features to the vehicles for the betterment of the system.

e-Sushrut – Hospital Management Information System (HMIS)

C-DAC has indigenously designed and developed the "e-Sushrut", a full-fledged Hospital Management Information System that provides an indispensable mechanism for digitizing and streamlining the workflow of hospital services. During this year, e-Sushrut deployment in the country has taken another leap by adding 715+ Indian Railway Hospitals across India & various AIIMS centres across India viz. Patna, Raipur, Mangalgiri, Bhubneshwar, Raebareli, Nagpur, Gorakhpur, Bhatinda, Kalyani and Deogarh. Also, Government of Maharashtra has approved the State wide implementation of e-Sushrut HMIS across 746 Health Institutes of Maharashtra.

NDHM Building Block and FHIR Compliant e-Sushrut

To exchange the e-Sushrut generated E.M.R with NDHM EcoSystem, e-Sushrut needs to support the building blocks of NDHM as well as FHIR. e-Sushrut application upgraded for Health ID Generation, sharing the electronics records to DigiLocker and exchange of care context with NDHM ecosystem.



e-Aushadhi – Drug and Vaccine Distribution Management System (DVDMS)

C-DAC's "e-Aushadhi" is a Supply Chain Management System for the distribution and supply of drugs and vaccines in the healthcare system of the country. During this year, C-DAC has signed the MoU with Directorate of Medical Education and Research, Govt of Maharashtra & Union Territory of Puducherry for deployment of e-Aushadhi for automating the drug supply chain in their respective health institutions. With inclusion of DMER Maharashtra & Puducherry e-Aushadhi's deployment tally has increased to 25 Instances in India covering 18 States, 2 Union Territories, 5 National Program under MoH&FW.

e-RaktKosh 2.0 – Blood Bank Management System (BBMS)

e-RaktKosh an initiative from MoH&FW is a centralized blood bank management system. It is a comprehensive IT solution streamlining the standard operating procedures, guidelines and workflow of blood banks in accordance to NACO and NABH guidelines. e-RaktKosh has onboarded more than 2100 blood banks in 32 States / UTs across the country. MoH&FW has further approved e-RaktKosh 2.0 for enabling features like Chatbot, Stock Prediction, Bilingual Portal, Online Donor and Blood Requests etc. During these difficult times of COVID-19 it helped donors as well as patients to connect with the Blood Bank.

e-RaktKosh 2.0 – Blood Bank Management System (BBMS)

eBloodServices for Indian Red Cross HQ Delhi

eBloodServices mobile app for IRCS, NHQ Blood Bank primarily facilitates transparency and single window access to blood services of IRCS, NHQ. Any person, who needs blood, can download an App and seek blood by filling in relevant blood information. Citizens will get the details of the place where blood is available and can collect it during the next 12 hours. It helped IRCS to meet the urgent blood demand during COVID pandemic. The app was launched by Dr Harsh Vardhan, Hon'ble Minister of Health and Family Welfare on June 25, 2020 in Delhi.

e-Upkaran – Equipment Maintenance and Management System

C-DAC's e-Upkaran is a web-based Equipment Maintenance & Management System. It deals in purchase, supply, inventory & complaint management of bio-medical equipment's by linking health institutes. The system ensures that these equipment remain safe for its intended use with extended operational life by various interactive solutions e.g. Integration of third party IVRS and Call center, Alert Management System, Mobile Apps, Live Dashboard, Bank Payment & Digital Signatures. During the reporting year, C-DAC has signed MoU with State of Tamil Nadu, Directorate of Medical Education and Research, Govt of Maharashtra & State of Odisha. With these deployments, the e-Upkaran has now been deployed in 9 States.

Aakanksha - Radiation Treatment Planning System: Aakanksha

Radiation Treatment Planning System for HDR Brachytherapy India has a large cancer treatment burden, and radiation treatment is an important treatment technique in cancer cure and management. The Radiation Treatment Planning System (TPS) provides radiation experts (oncologists and physicists) a visual tools and controlled workflow to ensure treatment efficacy and patient safety by assisting in planning approach path, radiation level & exposure, etc. The TPS systems are tightly dependent on the treatment type chosen, the treating machine to be used, and the radioactive sources available. The Aakanksha system is an indigenously developed Radiation TPS for Telecobalt Radiation machines and High Dose Rate Brachytherapy machines manufactured in India. Aakanksha Radiation TPS for Brachytherapy is developed under an ongoing project funded by the Department of Atomic Energy (DAE) through Tata Memorial Centre (TMC), Mumbai.

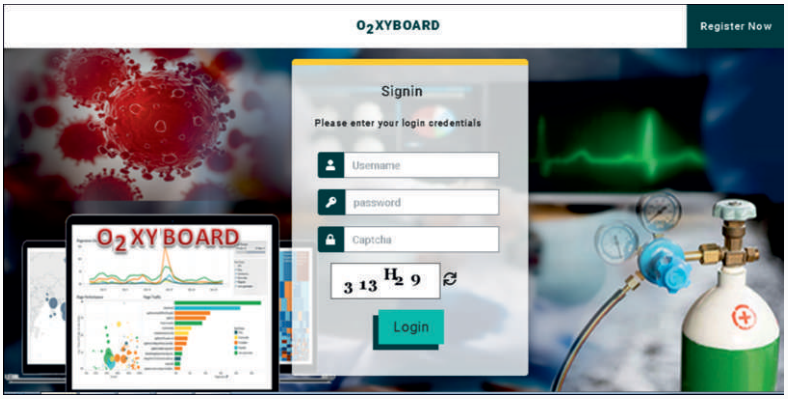
Radiation Treatment Planning System

XRAYCAD

X-RAY Computer Aided Diagnosis (XRAYCAD) Software Solution is a Web Application Portal for assisting doctors in Chest X-Ray Diagnosis. The Solution has an Artificial Intelligence Engine backend that can facilitate Computer Aided Diagnosis for the Chest X-Ray images uploaded. The Software solution identifies 14 disease pathologies associated with Chest X-Ray and has an accuracy of 0.839 AUROC (Area Under Receiver Operating Characteristics)

OxyBoard (Oxygen Management System)

OxyBoard, which provides the real time data about the availability of Oxyzen, is a comprehensive system for assisting authorities in managing the availability of oxygen across health facilities in Indian States. The solution enables Real time Data Capturing and Monitoring Availability of Oxygen in States and Public facilities. It also provides actionable view for Decision Makers. The POC of the system is being done in State of Tamil Nadu.



Oxygen Management System

Indigenous Magnetic Resonance Imaging (IMRI)

A National Mission Swadeshi Chumbakiya Annunad Chitran – Ek Rastriya Abhiyan (SCAn – ERA). Sub Project – MR Image Visualization. The developed product is a MR Image Visualization software that enables quantitative analysis and visualization to investigate the anatomy and physiology of the body. The tool will help doctors in diagnosing and monitoring conditions affecting internal organs, tissue and bone. The software comprises of modules such as Diffusion Imaging, Perfusion Imaging, Segmentation and Denoising, based on prototype algorithms furnished by Medical Imaging Research Centre, Dayananda Sagar University, Bengaluru, Karnataka.

Health Standards

Common Drug Codes for India (CDCI)

Common Drug Codes for India is a set of files that integrate with SNOMED CT Global Medical Terminology files and content for use in any data entry, analysis, or record exchange systems that adhere to MoH&FW notified Electronic Health Record Standards for India 2016 guidelines. Common Drug Codes for India include generic (clinical drug), supplier and branded medicine concepts which when used along with SNOMET CT International Release covers all medicines (except devices) surgical implants and combi packs, from National List of Essential Medicines (NLEM) 2015, Pradhan Mantri Jan-Aushadhi Yojana, COVID-19 Vaccine Products (Covishield & Covaxin), etc. The Extension along with SNOMED CT International Edition offers a total of Generic 7122 and 25808 Branded Medicines. The Flat Files Package is free for use under Creative Commons Attribution 4.0 International Public License.

C-DAC's SNOMED CT Toolkit (CSNOtk)

C-DAC's SNOMED CT Toolkit (CSNOtk) v6.5 provides the APIs and software tools for simple and rapid integration of SNOMED CT in healthcare applications. The updated version of the toolkit now supports OpenJDK 1.8.0 and new APIs for supporting querying on Drug Information Service. The newly released version is optimized for enhanced performance along with updated import of national extension along with RefSet files. Along with many other features the new release has updated to support for Sanskrit, Tamil and Urdu Language.

Health Information Systems

Advanced Epilepsy Research (AER)

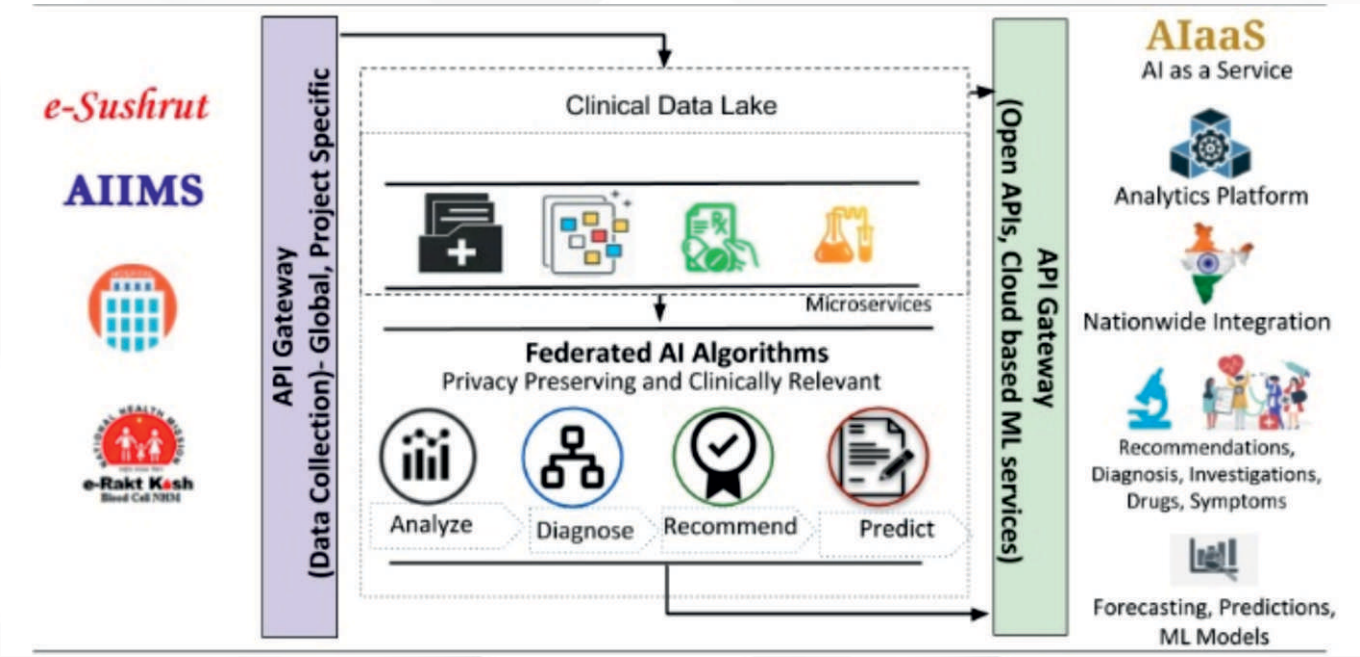
Epilepsy is a traumatic neurological disease for which a number of drugs are being used with varying degrees of success. Ensemble classifiers and stacking approaches have been applied to build machine learning models for identification of such potential protein targets with high accuracy. The platform termed Target Research in Anti-Epileptic Drugs using Data Science tools (TREADS), exclusively for epilepsy research, was released to the collaborators and in the public domain for the benefit of research community. The advantage of the platform is to narrow down the protein search space and consider only those targets identified with high accuracy for in-depth studies such as drug-target binding.

Vaanimitr: AI enabled Voice Analytics to detect COVID-19

"Vaanimitr" is an indigenous automated AI system which can detect signatures of Covid-19 infection in the human cough sounds. This will help in preliminary screening of COVID-19 patients remotely. This system records your cough and analyses with Machine Learning Algorithms-based AI model. The system is being developed in collaboration with NHM Haryana and University of Cambridge, UK.

Machine Learning Based System by Predicting Treatment, Advice and Diagnosis

The solution is a machine learning based system for diseases, that suggests possible treatment, advice, lab tests and diagnosis, based on patient demographics (age, gender, location), seasons, symptoms, examination, history of present illness and past treatments. The suggestions are ranked by probability of outcome to indicate the confidence of the system in the suggested value against the input fields. This will result in an anonymized labelled dataset that is suitable for processing by AI algorithms and incorporation of the same in live environment through its integration via Open APIs with HMIS. As part of this initiative, Lab Test Recommendation System has been incorporated in e-Sushrut HMIS for POC. The project is funded by MeitY.



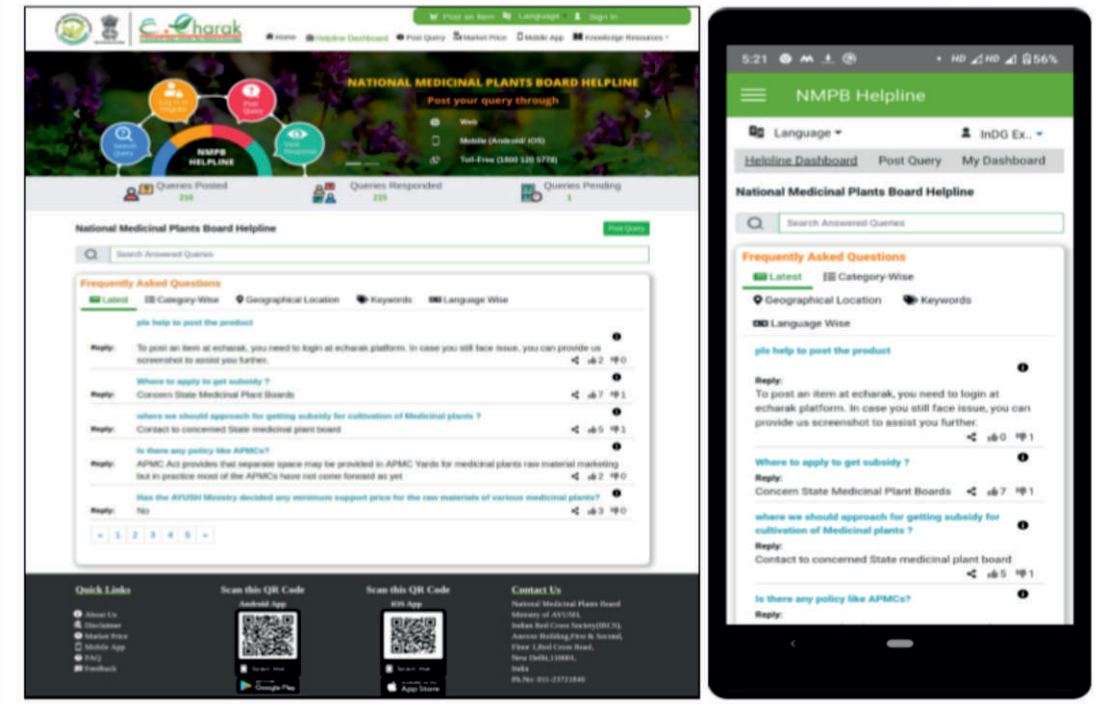
e-Sushrut HMIS

Middleware, Applications & Platform for 5G Environment

The Middleware, Applications & Platform for 5G Environment is developed to carry out experimentation of 5G/QoS for telemedicine and healthcare applications. Telemedicine application is being tested for high bandwidth for transmitting medical images over 5G environment and health care applications (Doctor Desk) is being tested for low latency using 5G by integrating speech facility for generating prescription.

National Medicinal Plants Board (NMPB) Helpline

NMPB Helpline is a multimodal (web, mobile and IVRS), multilingual query redressal system that seeks to address specific issues of Medicinal and Aromatic Plants stakeholders across the supply chain by experts located nation-wide. The Helpline was formally launched virtually on October 13, 2020 by Shri Shripad Yesso Naik, Hon'ble Minister of State (IC), Ministry of AYUSH, Govt of India.



Multimodal NMPB Helpline

Education and Training

C-DAC's Education and Training group has been developing the skilled resources as part of Skill India initiative through its Post Graduate Diploma as well as Post Graduate Degree awarding programmes for its internal human resources needs of Research & Development activities as well as IT industry. These skill enhancement ICT training courses are imparted by C-DAC training centres as well as Authorised Training Centres spread across India.

C-DAC's education and training division is involved in the following activities:

- Post Graduate Diploma courses in ICT
- Education and Training Technologies
- Comprehensive Recruitment System
- IT & Skill Development programmes for Capacity Building

Following major activities were carried out under these categories during the year:

Post Graduate Diploma courses in ICT

C-DAC Advanced Computing Training School (ACTS) has trained and placed students in 13 Post Graduate Diploma Courses (NSQF level 8 course) through a network of over 30 C-DAC training centres and Authorized Training Centres located in pan India. The Advanced Computing Training School (ACTS) of C-DAC offers following 6 months PG Diploma courses, conducted twice in a year.

- PG Diploma in Embedded Systems Design (PG-DESD)
- PG Diploma in Systems Software Development (PG-DSSD)
- PG Diploma in Advanced Computing (PG-DAC)
- PG Diploma in IT Infrastructure, Systems and Security (PG-DITISS)
- PG Diploma in Advanced Secure Software Development (PG-DASSD)
- PG Diploma in VLSI Design (PG-DVLSI)
- PG Diploma in Artificial Intelligence (PG-DAI)
- PG Diploma in Big Data Analytics (PG – DBDA)
- PG Diploma in Mobile Computing (PG-DMC)
- PG Diploma in Biomedical Instrumentation and Health Informatics (PG-DBIHI)
- PG Diploma in HPC System Administration (PG-DHPCSA)
- PG Diploma in Geo-Informatics (PG-DGI)
- PG Diploma in Internet of Things (PG-DIOT)

Online Diploma and Certificate courses

Four new courses have been designed under online Diploma Programme

- e-Diploma in Artificial Intelligence (e-DAI)
- e-Diploma in Big Data Analytics (e – DBDA)
- e-Diploma in Mobile Computing (e-DMC)
- e-Diploma in IT Infrastructure, Systems and Security (e-DITISS)

These courses focus on skills needs in Emerging Technologies and requirements of IT industry. The students shall gain an in-depth understanding of the course majorly focusing on practical aspects and get an immediate placement assistance after the completion of the course.

During the year 2020 - 2021, C-DAC has trained 1750 students in four online Diploma courses in the domain of Artificial Intelligence, Big Data Technology, Mobile Computing and Advanced Computing inducted through the national level C-DAC Common Admission Test (C-CAT). Over 90% of these trained and certified students are placed in the leading IT and Electronics companies through the National Common Campus Placement Programmes (NCCPP).

Education and Training Technologies

e-Learning Systems and Solutions

Megh-Sikshak

MeghSikshak is an advanced Learning Management System (LMS) which provides flexibility for customisation, scalability and high availability for offering various e-learning services without the need for hardware and software resources at end user premises. During the year, C-DAC provided maintenance and technical support for MeghSikshak implementations at the Bureau of Police Research & Development (BPRD), Ministry of Home Affairs and Maharashtra Police Academy(MPA), Nashik.

Rollout of Online Labs for Schools

C-DAC in collaboration with Amrita University has developed Online Labs (OLabs) covering experiments of Physics, Chemistry, Maths, Biology and English for class 9th -12th. The aim of the initiative is to create infrastructural and support framework for making OLabs (online labs for schools) accessible and usable by students and teachers across India and to train approximately 30,000 teachers across India. For OLabs Offline OLabs Windows Installer is available and is updated periodically with the website dump. During the year, C-DAC trained 17,229 teachers from 2021 schools of different State boards. A total of around 48,493 teachers covering around 12,093 schools across India have been trained by both C-DAC and Amrita University through direct training and via video conferencing.

Online Examination

AFCAT and CASB/STAR

C-DAC has developed a comprehensive "Online Examination" system for recruitment of Indian Air Force (AFCAT & STAR) and Indian Coast Guard (ICG) personnel, which encompasses Online Registration, Account Reconciliation, Admit Card generation, Pre-Exam activities, Exam conduction across 100+ cities - using C-DAC's indigenous Exam Software executed in BOSS PXE environment, Result processing, Post-Exam activities etc. STAR (Scheduled Test for Airmen Recruitment) is conducted for recruitment of candidates as Airmen in various trades. ICG conducts examination for the recruitment of Navik- General Duty (GD) and Navik-Domestic Branch (DB) and YANTRIK. C-DAC conducted Online Exam for 10.22 lacs candidates in FY 2020-21 for IAF & ICG.

MY IAF Application

My IAF is an Official Indian Air Force mobile app for easy accessibility regarding IAF information / activities such as exploring Career Opportunities as Officer or Airman in IAF through Pays & Allowances, Service Perks, training details, Post-Retirement Benefits, etc. The app showcases various IAF activities through Glimpses, Videos, Quizzes and also captures information to analyse the interests of people in Indian Air Force services. C-DAC has developed this app for IOS and localised the app in Hindi as well. So far, the app has been downloaded by 1.21 Lakh people.

Indian Air Force Mobile App

Statistical and Probability analysis centre (SPAC) for IAF

SPAC is an application funded by Indian Airforce (IAF) for the analysis of various aspects of the IAF exams graphically and statistically. This application could be used for various activities such as outreach Statistics, Centre wise Selection Statistics, Question Number Analysis, Marks Distribution, Population Migration, Slot-wise marks statistics, Section-wise Comparison, etc.

Process Automation for Competitive Exams (PACE)

Process Automation for Competitive Exams focuses on competitive exams such as Graduate Aptitude Test in Engineering (GATE), Joint Admission Test for Masters (JAM), All India Institute of Medical Science - AIIMS (PG, MBBS, BSc Nursing), National Board of Examination (NBE). PACE does automation of various stages such as candidate registration, online application filling, application scrutiny, exam centre allocation, admit card generation, result processing, score-card generation, choice filling, application scrutiny for admission, seat counselling. Using this software, C-DAC conducted recruitment process for more than 9.5 Lakh candidates in the year 2020 -21.

Web-based System for Indian Coast Guard

C-DAC has developed a web-based system which includes an online registration system to facilitate Online Comprehensive Recruitment System. ICG application is a Recruitment System for Indian Coast Guard (Enrolled Personnel) (CGEPT). This recruitment process will be mainly for Navik (DB), Navik (GD), and Yantrik branches /trades.

eAkadamik – Online Admission System

eAkadamik is an automated online admission system for academic institutions for the effective management of departments, faculty and students. The system supports role-based access and helps in assigning subjects/courses, managing attendance, exam-marking, assignments etc. Online counselling and management of candidates with online Payment is also supported. The solution is deployed at University Institute of Engineering and Technology Chandigarh, University Institute of Engineering and Technology Hoshiarpur, Chandigarh college for engineering and Technology Chandigarh, Punjab Engineering College (PEC) Chandigarh, Universal Group of Institutions Lalru and Punjab School Board of Technical Education. The system has been deployed for all the Govt. / Private institutes across Punjab/U.T. Chandigarh.

Automated Question Paper Generation System (AQPGS)

C-DAC has designed and developed an automated question bank & paper generation system which will cater to various types of MCQ, Template/blueprint design for various sets of Question Papers for covering all units and subunits of subject, Effective use of questions depending on their difficulty levels, categories etc., and Random and unbiased process for Question Paper generation with less processing time. The algorithm used in this software enables randomization of questions and prevents repetition as well.

IT Skill Development programmes for Capacity Building

Skill Development and Enhancing Employability for SC/ST Candidates

This initiative envisions to generate trained workforce of SC/ST Category in IT/ITeS Sector and helps them to reorient themselves in the light of emerging employment opportunities through a residential training programme by involving state-of-art training providers across the country. This would also take into account Job-roles/ National Occupational Standards (NOS) in IT/ITeS Sector, which would specify the standard of performance, knowledge and understanding, along with mechanisms for assessment and certification. The candidates will be trained for employability for identified 10 IT/ITes Courses- Domestic IT Helpdesk Attendant, CRM Domestic Voice, CRM Domestic Non-Voice, Domestic Data Entry Operator, Engineer-Technical Support (Level-1), Web Developer, Associate-CRM, Software Developer, Sales & Pre-Sales Analyst, and Associate-Analytics. The training for NSQF Level 4 & 5 courses are imparted at SSC, NASSCOM Certified Smart Empanelled Centres and Level 7 being residential courses are to be conducted by C-DAC Centres. Training of ST Candidates for L-4 & L-5 courses at 14 locations in 09 States has been completed.

PMGDISHA

C-DAC continues to participate in PMGDISHA program as Assessment and Certifying Agency. PMGDISHA is a central government's initiative of Digital Literacy Program in the country. The aim of the initiative is to make at least one person in each household digitally literate to interact with digital world such as digital payment and e-government services. During the year 2020-21, C-DAC has proctored more than 22.5 lakh citizens across the country.

FutureSkills PRIME

The project, FutureSkills PRIME (Programme for Re-Skilling/Up-Skilling of IT Manpower for Employability), approved by MeitY under the Campion Sector Service Scheme(CSSS), aims to re-skill/up-skill 4.12 Lakh IT Professionals in five different categories: Deep Skilling Course, Bridge Course, Foundation Course, Government Official Training Program and Training of Trainers Program over the period of 03 years in ten(10) emerging technologies such as 3D Printing/Additive Manufacturing, Blockchain, Cyber security, Internet of Things, Artificial Intelligence, Robotic Process Automation, Social & Mobile, Big Data Analytics, Cloud Computing and Augmented Reality/Virtual Reality. The re-skill/up-skill training in all five categories in 10 emerging technologies is being conducted by C-DAC/NIELIT/NASSCOM Centres/content providers, for the beneficiaries across the nation trough Hub-n-Spoke mode. In order to promote the novel skilling ecosystem across the country, the programme would incentivize cost of the courses to the beneficiaries on successful certification, would provide authentic and accredited certifications that are acceptable in the industry. The beta version of the online platform, FutureSkills PRIME Platform was launched on November 18, 2020 by Shri Ajay Prakash Sawhney, Secretary, MeitY, Govt. of India.

C-DAC's HARmonized industry skilling program through Online Training (CHARiOT)

CHARiOT is an online industrial training program for upskilling students of B.E/B.Tech (CSE, IT and ECE) and other equivalent disciplines. As part of this program, 3 courses on emerging technologies are currently being offered:

- Blockchain Technology and Application Development (BLEND)
- Hardware Design & Development for Embedded Systems and Internet of Things (HANDS-ON)
- Multilingual Cross Platform Mobile App Development using React Native Framework and Firebase (MENTOR)

The aim of the program is to equip students with a practical understanding and exposure of emerging technologies as per industry processes and standards. These courses will be covered in an online mode for a duration of 4 weeks and will be facilitated by R&D experts of C-DAC. The student will be required to undergo about 100 hours of conceptual and practical oriented training and will receive a C-DAC certificate on successful evaluation. This training shall target around 5000 students per annum.

C-DAC Mission Mode Programmes

C-DAC had firmed up its six mission mode programmes based on detailed discussions with PAN C-DAC teams and taking valuable inputs given in the 6th Technical Advisory Committee (TAC) meeting of C-DAC held on July 1, 2020. Each vertical and the activities/projects of all these missions have been carved out which included detailed objectives, impact, methodology and timelines for the following six Mission mode programs.

1. Exascale Computing Mission
2. Microprocessor and Professional Electronics Mission
3. Quantum Computing Mission
4. AI and Language Computing Mission
5. IoE, Dependable and Secure Computing Mission
6. GenNext Applied Computing Mission

Exascale Computing Mission

In line with the Government of India's "Make-in-India" Initiative, C-DAC is actively pursuing research, design, development and deployment of infrastructure, applications, and capacity building under National Supercomputing Mission (NSM). Building Exascale Capable Systems is the key enabler for accelerating Scientific Discovery and Innovation. Exascale Mission shall capitalize these efforts and further leverage the HPC-AI Converged Approach towards building next generation exascale systems. The Exascale Mission shall nucleate untapped areas such as Materials science, Earth science, Energy assurance, Fundamental science, Biology & Medicine, Engineering design, and National security, which are of immediate global importance.

During the year, C-DAC carried out Indigenous development of Rudra Server Platform, HPC interconnect (Trinetra), Indigenous HPC System Software Stack development and initiated Indigenous AUM - HPC processor development. C-DAC also initiated HPC applications development under NSM project and has established several Supercomputing sytems across various institutions in the country.

Microprocessor and Professional Electronics

Under the umbrella of "AtmaNirbhar Bharat", towards Self-Reliance, development of indigenous Microprocessor is of national importance. C-DAC has embarked on this Mission towards development of indigenous Microprocessor development along with necessary ecosystem for product developments. In addition, C-DAC, with its expertise in Professional Electronics, focuses on development of solutions for Next Generation Communication Technologies, Strategic Electronics & solutions and Power Electronics.

As part of Microprocessor & Professional Electronics Mission, C-DAC has developed Vega series of processors and has offered the same for the MeitY's Swadeshi Microprocessor Challenge and initiated activities under NAMPET-Phase-III for power electronics.

Quantum Computing

Quantum Computing is gaining traction with advancements in materials science and computer science. Realizing the importance of the area and its applications including Quantum Cryptography, C-DAC has evolved this mission that focuses on Quantum Computer Development, Quantum Communication, Quantum Key Distribution, Post Quantum Cryptography and Quantum Resistant Cryptography, Quantum Sensing, Quantum Computing Simulation, and Quantum Algorithms and Applications.

Under Quantum Computing Mission, C-DAC is developing Qsim along with IISc Bangalore and IIT Roorkee.

Artificial Intelligence and Language Computing

As our nation embarks upon its most revolutionary phase of Digital Transformation, multitudes of reformative and transformative changes under the Digital India Vision of India. Language Computing is the key aspect towards realization of the same. With its proven expertise over the decades, C-DAC is well positioned to pursue pioneering research in Language Technology dissolving the language barriers. This shall include development of Intelligent Systems based on combination of Big Data Analytics, Cloud Computing, Machine-to-Machine communication, Robotics and the Internet of Things (IoT) to learn, operate and accomplish.

As part of AI & Language Computing Mission, C-DAC has setup HPC-AI Infrastructure called PARAM Siddhi - AI of 210 AI Petaflops 6.5 Petaflops Peak DP which was Ranked at No. 62 position in TOP500 globally, and Ranked No.1 in TopSC.in – February - 2021 (Top Supercomputers-India) and gearing towards National Language Translation Mission.

IoE & Dependable and Secure Computing

India is witnessing considerable increase of digitization enabled by prolific use of internet and Smartphone across the globe. Advancements in technologies such as IoT, SDN and 5G are the key enablers for usage of the same by critical sectors. However, there is also a growing concern on the rapidly growing threat-ecosystem. This requires dynamic self-healing based approaches to ensure security and safety of the environment. In view of the same, C-DAC has prepared a three-pronged approach involving, innovative defence mechanisms, novel deterrence methods and effective response & recovery.

Under Internet of Everything (IoE) & Dependable and Secure Computing Mission, C-DAC is developing Cyber Security and Cyber Forensics Solutions and SDN based 5G middleware.

GenNext Applied Computing

In line with the key national initiatives such as Digital India, Digital Health Mission, Skill India, Smart cities, National Education Policy, Agriculture Policy, Smart grid and Digital payments, C-DAC has craved this Mission. This mission encompasses common technological elements such as GIS based services, Image Processing, Blockchain enabled trust environment, Immersive & Interactive technologies, AI & Analytics, Multi-lingual computing, Security framework and High-Performance Compute Infrastructure.
Under the GenNext Applied Computing Mission, C-DAC has been identified as a nodal agency for implementation of various mega projects at national level.

Outreach Initiatives

Products Services & Outreach team enabled comprehensive dissemination and leveraging of novel business opportunities through efficacious outreach. Its mandate is to steer multi center consortia projects of commercial nature, curate effective strategies and methodologies to go to market so as to unravel the immense wealth generation potential.

Noteworthy business contracts bagged were from Employee Provident Fund Office for Creation of Sandbox Environment and Preparation of Architecture and Implementation Plan for the Common UAN Program for Organized and Unorganized Sections, CEO Karnataka for providing technical resource for ERONet to the Office of the Chief Electoral Officer, Karnataka, CRIS - Development of software solution for fixed and portable RFID readers to support automating tracking and maintenance operations of railway assets, Defense Services Staff College (DSSC), Wellington - Revamp of Network Infrastructure and BOSS Enterprise Management Solutions, modernization of Traditional Knowledge Digital Library (TKDL) - Modernization and integration of TKDL software applications for enabling access to Traditional Indian Medicinal Knowledge, customization of Control Software Packages for DLRL (DRDO), installation, commissioning of CT-VIEU systems (8 nos.) at different APMCs for the state of Telengana,

eSeHat OPD Services - Customized eSanjeevani for tri-services, design and development of Enterprise-wide ERP system for ECGC Ltd, Drug and Vaccine Distribution Management System (DVDMS) is a web based Supply Chain Management System that deals in Purchase, Supply, Distribution and Inventory Management - Manipur; Meghalaya; Arunachal Pradesh; Mizoram and e-HRMIS is a web based online Human Resource Management System Meghalaya.
To enhance C-DAC's foot print various engagement models have been conceived keeping the commercialization policy approved by governing council in mind which will catalyze all centers to take their products and service to the market in a systematic and organized manner. This will reap rich dividends and ensure successful monetization of our research and innovations.

Towards wide scale proliferation of technologies, solutions and services, C-DAC has evolved strategy by way of announcing Intent of Association (IoA) and Expression of Interest (EoI) for collaborative innovation and channel partners respectively. The same is implemented with approval from the CDAC's Governing Council.

Intent of Association (IoA) for Collaborative Innovation
The objective of IoA is to pool resources with organizations in ICTE areas for Collaborative Innovation. Such entities with their expertise in related areas should be poised to explore new avenues jointly. The interested agencies should be suitably equipped to co-create along with C-DAC and provide the requisite resource (finances) for proposed solutions research. Once the collaborative R&D shapes up based on the strengths of each party into a product/solution, the revenue will be shared based on present valuation of the technology and value added to it for making commercial product/solution.

In order to meet the stated objective, C-DAC invited proposals from the Companies (including private limited companies, PSUs, MSMEs and start-ups), R&D institutions (comprising academia, research institutes, R&D organizations and companies), Firms, Partnership Firms, Trusts and Societies working in niche technologies in India and having requisite expertise in R&D/contract research for doing collaborative innovation. Many organizations applied through this channel and are working in close conjunction with various C-DAC centers for innovative technologies. A few proposals are close to maturity.

Expression of Interest (EoI) for Channel Partners
The objective of the EoI is to empanel suitable organizations as Channel Partners, in order to enhance the footprint of C-DAC by way of increased deployment/sale/outreach of its products/solutions /services/technologies categorized under various thematic areas.

In order to meet the stated objective, C-DAC invites expression of interest for empanelment of Channel Partners for individual centers, who have adequate experience and carried out similar type of work, for wide scale deployments of solutions, system integration, customization, liaising with public/private entities, business development & promotion, sales & support, collaborative application-oriented R&D, etc.

Expression of Interest for Technology and Development Partners
Expression of Interest for Technology & Development Partners was published for identifying agencies to execute various large scale business project undertaken by C-DAC which entails development, testing, implementation, maintenance and support of software systems. C-DAC has identified two potential organization and taking help for guidance in projects of national importance.

Transfer of Technologies
S&T organizations of the Government of India are required to maximize transfer of know-how developed by them to industry and thereby make their contributions to technological self-reliance, industrial and economic growth and development of the country. It is imperative to disseminate the fruits of their enterprise to various sectors of the economy and generate mechanisms for effective transfer, and the returns to the nation as a whole would whereby creating a synergistic impact. It is therefore incumbent on premier R&D organizations in the country like C-DAC to effect maximum technology transfer to Indian Industry. C-DAC undertook ToT for Traffic Signal Monitoring & Management software (TraMM-EnV), C-DAC Urban Traffic Controller Equipment (CUTE), C-DAC TETRA Network for critical communication to strategic sector.

GeM platform for sale of products and services
To promote sales through eChannel's, GeM platform is increasingly being used to publish and sell. 29 products and services are published including IoT Research Lab Kit, USB Pratiroadh, Cloud Administrator, Secured ISOC, e-Hastakshar, Secured BOSS Open Source OS, Go-Translate, MeghSikshak - eLearning Software, Rice Grain Analyzer, COPS SCADA Lab Kit, Tarang - Digital Hearing Aid, Meghdoot Cloud Suite, Interface board for Raspberry Pi.

Resources, Facilitation Services and Initiatives

International Collaborations/Initiatives

1. Collaborated with The OpenStack Foundation for authorized training, Consulting and Integration partner in Asia Pacific Region in Cloud Computing

2. With support from Ministry of External Affairs (MEA), C-DAC extends its expertise in ICT to collaborating nations and nurtures their ICT centres. During the year, the following activities were carried out as part of this initiative:
   - Completed installation and commissioning of IT Infrastructure at CESDT in Cambodia under the project, "Setting up of Centre of Excellence in Software Development and Training (CESDT) in Cambodia, Lao PDR, Myanmar & Vietnam and appropriate accreditation to these training courses by C-DAC"
   - Total 60 programs on more than 8 different tracks were conducted for more than 1800 candidates under the project, "Setting up of Centre of Excellence in IT at Al Azhar University Cairo, Egypt"
   - Completed setting up of India – Fiji Centre of Excellence in IT (CEIT) at FNU in Suva and C-DAC experts were deputed at IF-CEIT for centre coordination and course delivery
   - Out of total 11 certificate courses, completed 6 certificate courses under the project "India – Nauru Centre of Excellence in IT (CEIT) at Yaren"
   - Completed setting up of India – Cook Islands Centre of Excellence in IT (CEIT) at University of the South Pacific (USP) Cook Islands Campus in Rarotonga and C-DAC experts were deputed at IF-CEIT for centre coordination and course delivery
   - Conducted training in Big Data Technologies & Ethical Hacking and conducted public seminar on Cyber Security for Namibia Institute of Public Administration and Management under the project, "Setting up of India – Namibia Centre of Excellence in ICT & HPC at NUST in Windhoek"
   - Trained the AITI-KACE FOSS team at Bolgatanga and developed the Ghana EduOS with education applications and simulations for the easy learning under the project, "Capacity building in Research, Development & Innovation in ICT & Electronics through AITI-KACE by C-DAC"
   - Conducted Certificate Courses in Office Automation, Business Computing, Information Technology, Database Management, Java Programming and Advanced Web Technology under the projects at
     - India – Papua New Guinea Centre of Excellence in IT (CEIT) at Port Moresby
     - India – Guyana Centre of Excellence in IT (CEIT) at Guyana
     - India – Samoa Centre of Excellence in IT (CEIT) at Apia
     - India – Niue Centre of Excellence in IT (CEIT) at Alofi

3. Collaborated with Moscow State University for development of approaches to the dynamic and precise management of monitoring systems for the operational control of the structure and intensity of data streams collected on highly scalable supercomputers

4. Collaborated with Efficient Power Corporation (EPC) Ltd, Plano, Dallas, USA in the area of GaN wide Band Gap device-based converters.

Patents and Copyrights

Patents Awarded

1. "Apparatus for estimation of quality of beverages through electrochemical sensing technology", Inventors: Hena Ray, Alokesh Ghosh, Amritasu Das, Tarun Kanti Ghosh, Rabindranath Kanjilal, Dr. Nabarun Bhattacharyya, Application No.-856/KOL/2015, Patent No. - 336533 dated 6.5.2020
2. "A process for forming a Molecular Imprinted Polymer (MIP) based electrode for accurate quantitative detection of total TheaFlavin (TF) in black tea", Inventors: Dr. Nabarun Bhattacharyya , Trisita Nandy Chatterjee, Runu Banerjee Roy, Prof. Bipan Tudu, Prof. Panchanan Pramanik, Pradip Tamuly, Prof. Rajib Bandyopadhyay, Devdulal Ghosh, Patent No. - 342192, Date- 22. 7.2020
3. "A High Voltage high Pulse Power switch using Electrically triggered Thyristor", Inventors: Dr. Subhash Joshi, Aby Joseph, Dr.Lakaparampil and Dr.Vinod John, Patent No. 338970 dated 22.6.2020
4. "Selective harmonic Detection using cascaded virtual Sync reference frame", Inventors: Dr. Subhash Joshi, Aby Joseph and A. K. Unnikrishnan, Patent No. 350920 dated 5.11.2020

Patents Filed

1. "Method of Adaptively Varying Inter-Frame Gap Between Successive Ethernet Packets at Media Access Control Layer", Inventors: Vivian Desalphine, Anjana BL, David Selvakumar, Indian Patent Office. Application No.: 202041016423
2. "An autonomous apparatus and method for field health monitoring", Inventors: Ravi Sankar, Sangit Saha, Angshuman Chakraborty, Devdulal Ghosh, Tarun Kanti Ghosh, Hena Ray, Alokesh Ghosh, Tamal Dey, Abhra Pal, Gopinath Bej, Kabirul Hossain, Sabhyasachi Majumdar, Rabindranath Kanjilal, Dr. Nabarun Bhattacharyya, Patent Application No. 202031035536
3. "An apparatus and a methodology for quality assessment of apple using fusion of non-destructive technologies" Inventors: Gopinath Bej, Amitava Akuli, Tamal Dey, Abhra Pal, Vamshi Krishna Palakurthi, Sabyasachi Majumdar, Rabindranath Kanjilal, Jayanta Kumar Roy, Rishin Baneerjee, Dr. Nabarun Bhattacharyya, Patent Application No. 202031037302
4. "A less complex and decentralized active gate control method for enabling series connection of multiple metal oxide gate transistors while ensuring the fast switching", Inventors: Vamshi Krishna Miryala Saravanan, Dr. Kamalesh Hatua and Ganesan P, Patent Application No. IDF1972
5. "Portable Autonomous Temperature Controlled Medical Cabinet", Inventor: Dr. Subhash Joshi, Patent Application No. 202041054235
6. "Electronic unit for Ultrasonic solid-propellant Burn Rate Measurement System", Inventors: Haneesh Sankar Thekkeppatte, Harikrishnan Balakrishna Pillai, Sarath Chandran Ramachandran Nair, Rajesh Kalluvettamkuzhi Ramachandran, Sindhu Rajan, Dr. Jeenu Raghavan (VSSC) and Kiran Pinumalla (VSSC), Application No. 202041012431 dated 23-03-2020

Copyrights

Copyrights Awarded

1. "Dynamic Inventory Reordering Algorithm", Inventors: Priyesh Ranjan, Sumit Soman, Amarjeet Cheema and Praveen Srivastava, Copyright Registration No: SW-13817/2020 dated 14. 10. 2020
2. "Remote Power Management Interface v1.0", Inventors: Chandrasekar V, Udaya Sagar V and Lakshmy S P, Diary No: 11335/2020-CO/SW, RoC No. SW-14055/2021 dated 5.1.2021
3. "AMI Compatible Single Phase Simulator (Version 1.0)", Inventors: Jiju K, Sreedevi V S, Priya S and Dhanyamol S, Diary No: 18771/2020-CO/SW, RoC No. SW-14047/2020 dated 29.12.2020
4. "USBRMS ARM Firmware ", Inventors: Rajesh K R, Harikrishnan B, Sindhu R and Haneesh Sankar T P, SW-13098/2019
5. "Advanced Automated Call Distribution System", Inventors: Rajesh Kumar R , Vimal Surendran and Kalai Selvan A, SW-13626/2020 dated 19. 08. 2020
6. "ACDS online Monitoring Application", Inventors: Sreeraj S, Rajesh Kumar R and Vikas V, SW-13628/2020 dated 19.08.2020
7. "Autoconf Utility for Automatic Configuration of Automated Call Distribution System", Inventors: Rajesh Kumar R and Kalai Selvan A, SW-13617/2020 dated 18. 08. 2020

Copyrights Filed

1. "MaxSim: Maxillofacial Surgery Planning and Simulation System", Inventors: Deepak M, Ranjith K O, Byju N B, Devanand P and Dr. Alexander G, Application No.: 8072/2021-CO/SW
2. "Bus stop Survey App: Mobile App to capture geo-location and attributes for bus stops", Inventor: George Thomas and Abey SA, Application No. 8612/2021-CO/sw
3. "AMI compatible single phase smart energy meter firmware (Version 2.0)", Inventors: Jiju K, Sreedevi V S, Priya S, Dhanyamol S and Prakash Prasannan, Diary No: 19037/2020-CO/SW
4. "Smart UPS Firmware", Rajesh K R, Nimmy Pathrose, Vishnu S and Anish P A, Application No. : 495/2021-CO/SW dated 11. 11, 2020
5. "AGDS Recording/Playback Software", Inventors: Titus A Chazhoor, Rajesh K R, Joby Thomas and AnshulaVijayam S J, Application No. : 18769/2020 CO/SW
6. "Acoustic Gunshot Detection System Software in LabVIEW (AGDS-LV)", Inventors: Titus A Chazhoor, Rajesh K R, Joby Thomas and Parvathi M S, Ref. No. awaited

Awards and Recognitions

1. eSanjeevani – National Telemedicine Service received two awards:
   a. Digital India Award 2020 Platinum award for Innovation in Pandemic, which was conferred by the Hon'ble President of India on 30 December 2020 in New Delhi.

   b. SKOCH 2021 Gold Award in the category of Health

2. eSanjeevaniOPD - National Telemedicine Service received two awards:
   a. Gems of Digital India 2020 – Jury's choice award during March 2021

b. Digital Technology Sabha 2020 - Excellence Award during August 2020

3. Blockchain based Property Registration Management System received Skoch Gold Award in the category of Governance on July 30, 2020.

4. Received two Digital Technology Sabha 2021 Excellence Award in the category of 'Artificial Intelligence' by Express Computer during February'2021 for KarkatNirnayYantra (কর্কটনির্ণয়যন্ত্র) - An Infrared Imaging based Breast Cancer Screening System and Annadarpan SMART – A machine vision solution for appearance-based quality testing of rice.

5. Received Elets Healthcare Excellence Award for Contributions towards IT initiatives for COVID-19 Management in HMIS, eRaktKosh on August 21, 2020.

6. Received elets Healthcare Excellence Award for Practical Artificial Intelligence in Healthcare for developing novel algorithms and practical applications of AI in health informatics domain in the category of Technology in Healthcare on August 21, 2021.

7. Received "Best Industry Partner Award 2020" in recognition of the support received in terms of faculty and student training, internship, collaborative projects, curriculum development, etc. in the category of Industry Collaboration on the occasion of 19th Foundation Day Program of VIIT on October 14, 2020.

Events/Conferences

1. The e-Library project has established an e-library network across Bhutan with underlying Digital framework for providing online and offline e-contents at 49 Schools and 12 Colleges. The handing over of this project was done on June 26, 2020.

Handing Over of e-Library Network

2. As a part of "CYBHer" Awareness Month at Telangana, conducted various awareness programs including release of Awareness posters, Awareness Videos, Awareness workshops in collaboration with Women Safety Wing, Telangana police. Mrs. B. Sumathi, IPS, DIG (Women Safety Wing) released the Digital Parenting book during the event

Release of Digital Parenting book

3. As a part of eRakshabandhan awareness program at Vijayawada, Andhra Pradesh, Shri. D. Gautam Sawang, IPS, Director General of police – Andhra Pradesh, Shri. P S Sunil Kumar, IPS, ADGP- AP CID, Shri M Sunil Kumar Naik, IPS, DIG- AP CID and Smt. G P Radhika, SP - AP CID & Naina Jaiswal released awareness books on Information Security Awareness for Women on August 31, 2020.

eRakshabandhan awareness program at Vijayawada

4. Online Training program on Training Management Information System (TMIS) was conducted for Bureau of Police Research & Development (BPRD) and Central Detective Training Institute (CDTI) officials on October 29, 2020.
5. C-DAC has developed "Automated Aquaponics System for Vertical Farming in India" in collaboration with Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Punjab. The facility was inaugurated by Shri Sanjay Dhotre, Hon'ble Union Minister of State for Education, Communications and Electronics & Information Technology, Government of India at C-DAC Mohali on October 13, 2020.

Aquaponics Facility Inauguration by Shri Sanjay Dhotre, Hon'ble MoS, E&IT

6. Online Training program for Government officials on "Management of Digital Hygiene - Staying secure in cyber space" during December 21 -26, 2020.
7. Military Smart Card Operating System (MISCOS) was demonstrated at MISCOS Lab at Controller Personnel Services (CPS), Navy on February 20, 2021.

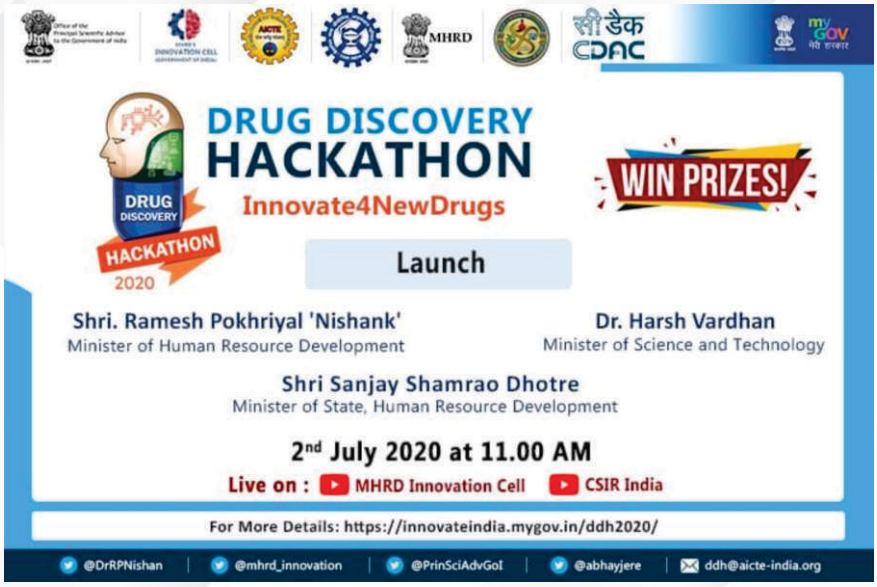
Demonstration of MISCOS

8. FutureSkills PRIME Platform (www.futureskillsprime.in) was launched on November 18, 2020 by Shri Ajay Prakash Sawhney, Secretary, MeitY, Govt. of India.

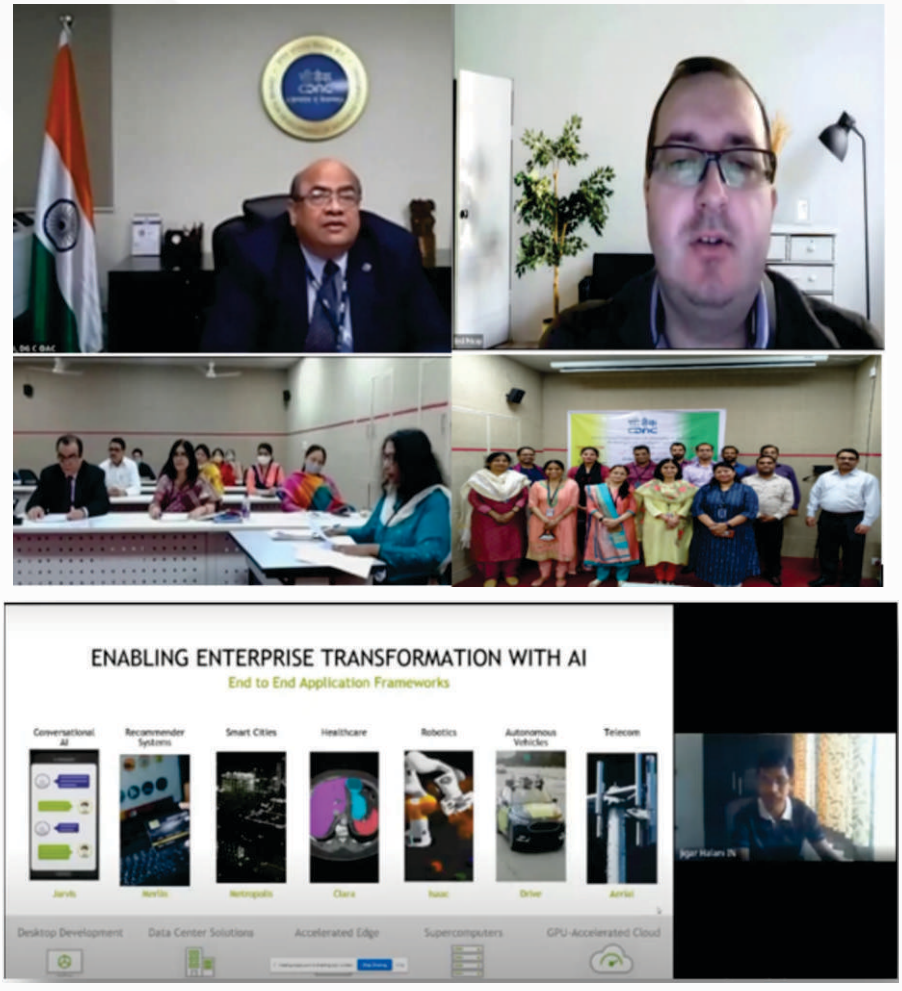
Launching of FutureSkills PRIME Platform

9. Online Conference for IRCS Blood Banks was conducted to provide awareness among IRCS Blood Banks for the use of e-RaktKosh Application on April 24, 2020.
10. Dr. Harsh Vardhan, Hon'ble Union Minister for Health and Family Welfare inaugurated the Drug Discovery Hackathon 2020 on July 02, 2020, along with Shri Ramesh Pokharial 'Nishank', Hon'ble Minister of Human

Resource Development (HRD) and Shri Sanjay Dhotre, Hon'ble Minister of State for HRD. C-DAC is playing a key role by providing the Virtual Tool Room facility for research based on HPC infrastructure of C-DAC & NSM.



11. Webinar Series on Artificial Intelligence and Data Science was conducted during March 20-May 2, 2021.



12. In order to make India a supercomputing major, an MoU was signed between C- DAC and 9 host institutes under NSM on October 12, 2020 for the establishment of Supercomputing facilities under Phase-II of the mission. C-DAC also signed MoU with 4 host institutes for establishment of Nodal Centres, for training in HPC and AI.

Signing of MOUs with premier institutions for hosting supercomputing facilities under NSM

13. The inauguration function of the HPC-Shiksha course being jointly conducted in online mode by the four NSM Nodal centres for training in HPC and AI was held in online mode on November 06, 2020. Prof. B K Mishra, Director IIT Goa delivering inaugural address in presence of Col. Asheet Nath (Retd.) Executive Director (Corporate Strategy and C-DAC Pune), Prof Sharad Sinha and Shri Ashish Kuvelkar

Launch of HPC Shiksha

14. Online PARAM Siddhi-AI User Training Program was conducted for various AI tools to demo and hand-on on applications on GPU during March 15-19, 2021.
15. First User's meet of the project on 'Development of Forest Fire Spread Model using Satellite Remote Sensing and Computational Models including CFD (Computational Fluid Dynamics) in Sikkim Himalayas using High Performance Computing (HPC) System' was conducted on November 23, 2020.
16. Drug and Vaccine Distribution Management System (DVDMS), a web-based supply chain management application was deployed in Mizoram and officially launched by Dr. R. Lalthangliana, Hon'ble Minister, Health & Family Welfare on July 14, 2020.

Launch of DVDMS in Mizoram

17. LVDC Powered Energy Efficient House Boat (LVDC-HB) was launched on February 17, 2021 by Captain. Abraham V Kuriakose, Port Officer, Alleppey in the presence of Shri. M. M Mani, Minister for Electricity, Dr. T. M. Thomas Isaac, Minister for Finance and Shri Kadakampally Surendran, Minister for Tourism, Govt. of Kerala.

Launching of LVDC Powered Energy Efficient House Boat

18. LIVE WEBINAR SERIES ON "VLSI SoC Design: Techniques and Recent Trends" for Faculties and students in different Engineering Colleges and Research Organizations was conducted during May 20-30, 2020.
19. Webinar Series on "Cyber Security and Forensics" for Faculties and students in different Engineering Colleges and Research Organizations was conducted during May 8-19, 2020.
20. Hardware Design Challenge Using Indigenous VEGA Microprocessor based THEJAS SoCs was conducted at C-DAC Thiruvananthapuram on November 26-27, 2020.

Research Papers/Publications

1. Vaibhav Pratap Singh, Haribabu P and Bindhumadhava B S, "COVID Curve Guides India's Health Infrastructure Growth Needs", Journal of Emergency Nursing, Volume 46, Issue 5, Pages 566-570, 2020
2. Shrivastava, Swapnil, "A Review of Spatial Big Data Platforms, Opportunities, and Challenges", IETE Journal of Education, Volume 61, Issue 2, Pages 80-89
3. Reddi Hareesh, Rajesh Kalluri, Lagineni Mahendra, R. K. Senthil Kumar and B. S. Bindhumadhava, "Passive Security Monitoring for IEC-60870-5-104 based SCADA Systems", International Journal of Industrial Control Systems Security, Volume 3, Issue 1, Pages 10, 2020
4. Rajesh Kalluri, Reddi Hareesh, M. V. Yeshwanth, R. K. Senthil Kumar and B. S. Bindhumadhava, "Hybrid SCADA Security Testbed as a Service", Power Research Journal, CPRI, Volume 16, Issue 2, Pages 10, 202
5. Gopinath Palaniappan, Sangeetha S, Balaji Rajendran, Sanjay Adiwal, Shubham Goyal and Bindhumadhava BS, "Malicious Domain Detection Using Machine Learning on Domain Name Features, Host-Based Features and Web-Based Features", DOI:10.1016/j.procs.2020.04.071, Elsevier, IIIT-M at Thiruvananthapuram, Pages 654-661, June 2020
6. Priyanka Jain, Ram Bhavsar, Karimullah Shaik, Ajai Kumar, B. V. Pawar, Hemant Darbari & Virendrakumar C. Bhavsar, "Virtual Reality: An aid as Cognitive Learning Environments", Springer Nature Journal "Virtual Reality", Volume 24, Special Issue of XR (VR, AR, MR) and Immersive Learning Environments, Pages 771–781, 2020
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Invited Talks

1. Ramesh Naidu Laveti, "Adversarial Robustness of Deep Neural Networks – Attacks, Defenses and Evaluation", ATAL Faculty Development Program, Coimbatore Institute of Technology, Coimbatore, October 7, 2020.
2. Ramesh Naidu Laveti, "Towards robust AI: Attacks, Defenses and Evaluation Metrics", Workshop on "Deep Learning for Cyber Security", SETS Chennai, March 07, 2020
3. R. K. Senthil Kumar, "Overview of C-DAC's Research Activities", Challenges in Industrial IoT & ICS Security, Virtual (IIIT-Kottyam), August 07, 2020.
4. K. Rajesh, "Research challenges in ICS Security", Challenges in Industrial IoT & ICS Security, Virtual (IIIT-Kottyam), August 07, 2020.
5. K. Jagan Mohan, "Research Challenges in IIOT", Challenges in Industrial IoT & ICS Security, Virtual (IIIT-Kottyam), August 7, 2020.
6. Vaibhav Pratap Singh, "Topic-IoT Reference Architecture and Standards", Faculty development program at Central University of Kerala, Online, January 14, 2021.
7. Vaibhav Pratap Singh, "Introduction to IoT and Blended Learning Programs", IEEE Partners Meet, IEEE India Office, Bangalore, February 24, 2021.
8. Dr. Balaji R, "Digital Signatures and Public Key Infrastructure", Foundation course on Cyber Security, Selected Govt. officials from various departments of Union Ministry, December 9, 2020.
9. Dr. Balaji R, "IoT Security and Privacy", AICTE Sponsored Online STPP IBDC (IoT, Big Data Cloud) 2020, Phase III, CMRIT, Bangalore, September 25, 2020.

10. Dr. Balaji R, "PKI and Blockchain for Trust in IoT", Internship and Training Program on IoT, IETE Bangalore, February 4, 2020.
11. Gopinath, "Malware detection, analysis and prevention", ATAL Academy FDP program, NIT, Trichy, September 10, 2020.
12. Solaimurugan V, "Data Sciences and Applications", AICTE Training and Learning (ATAL) Academy Online Faculty Development Programme (FDP), Online, Madras Institute of Technology, Chennai, December 15, 2020.
13. Dr. Priyanka Jain, "Read, Visualize, Evaluate and Analyse", EuropeClouds Virtual Summit 2020, Online, October 21, 2020.
14. Dr. Priyanka Jain, "A Data Story on evaluating an Automatic Text Visualization System", Women in Data Science (WIDS-Noida-20), Online, July 11, 2020.
15. Dr. Priyanka Jain, "Ethical AI in Scientific Research", Online All Women Virtual Hackathon by IEEE Student Branch of BVCOE in collaboration with Microsoft Student Partners (Wie-Hack 2.0), April 8-9, 2020.
16. Dr. Priyanka Jain, "Evaluating an Automatic Text Visualization System", Women in Data Science (WIDS-Pune-20), Pune, February 29, 2020.
17. Dr. Priyanka Jain, "It is Simple AI, be it explainable", 2-WEEKS REFRESHER COURSE" organized by UGC-Human Resource Development Centre, Punjab University, Chandigarh, Online, February 20, 2021.
18. Dr. Priyanka Jain, "Ethical and Responsible AI", IC2ST-2021 "International Conference on Convergence of Smart Technologies", Online, January 10, 2021.
19. M. K. Chaithanya, "Latest Trends in Mobile Security", ISEA Webseries, Online, Apr 22, 2020
20. Sandeep Romana, "A Structured Approach to Malware Analysis & Memory Forensics", TEQIP III - Third phase of Technical Education Quality Improvement Programme, Online, Jawaharlal Nehru Technological University, Hyderabad, January 29-30, 2021
21. P. R. Lakshmi Eswari, "Blockchain Technology", National Technology Day - R&D in Cyber Security: A Success Story", Online, SETS, Chennai, May 11, 2021.
22. P. R. Lakshmi Eswari, "Emerging Technology (Blockchain)", Foundation Course for AIS & CCS officers under the aegis of Lal Bahadur Shastri National Academy of Administration (LBSNAA), Dr. MCRHRDIT, Hyderabad, March 1, 2021.
23. P. R. Lakshmi Eswari, "Role of Cryptography in Network Security: DES & RSA Algorithms, SSL, SSH and IPSEc based VPN and PGP Protocols, Application of Cryptography, Digital Signature", Generic Online Training in Cyber Security for Central Government Ministries/Departments, Online, December 9 and December 12, 2020.
24. P. R. Lakshmi Eswari, "Blockchain Technology Challenges", Online Valedictory function of Online Faculty Development Program on Blockchain Technology: Challenges and Opportunities under information Security Education and Awareness (ISEA) Project Phase-II, Graduate School of Engineering and Technology (GSET), Gujarat, September 4, 2020
25. P. R. Lakshmi Eswari, "Case Studies on Blockchain Technology", 142 Officer Trainees of Special FC for AIS & CCS Officers and 33 Officer Trainees of 2nd FC for MES Officers, MCRHRDIT, Hyderabad, April 24, 2020.
26. Dr. S.V. Srikanth, "IoT for Smart Cities, Awareness in Action Program on Internet of Things (IoT)", Awareness in Action (AiA) NGO, Hyderabad, July 4, 2020.
27. Dr. S. V. Srikanth, "IoT for Agriculture Applications", New Dimensions in ICTs and Knowledge Management in Agriculture", ICAR-MANAGE, Hyderabad, September 2, 2020.
28. Dr. S.V. Srikanth, "Topic-Internet of Things (IOT) – Concepts and its Application in Agriculture", Digital Applications for Promotion of Marketing in Agriculture and Allied Sectors, Extension Education Institute, Hyderabad, August 26, 2020.
29. Dr. S.V. Srikanth, "IoT for Smart Cities", e-FDP on Internet of Things, SASTRA University, Tamil Nadu, February 27, 2021.
30. Dr. S.V. Srikanth, "IoT for Smart Cities", FDP on IoT and Artificial Intelligence, Rajasthan Technical University, February 15, 2021.
31. Santosh Sam Koshy, "IoT in Agriculture: Exploring the Possibilities", IEEE Rural Connect on Technology Backbone for Growth in Rural Communities, IEEE, Online Webinar, May 28, 2021.

32. Santosh Sam Koshy, "IoT Applications in Agriculture: Case Studies in Pest and Disease Forewarning", AICTE-ATAL FDP on IOT, Amity University, Online Webinar, October 15, 2020.
33. Indraveni K., "Smartphone Security", Online Session conducted by SCERT, Telangana, May 30, 2020
34. Indraveni K., "Use of Smartphones", Online Session conducted by SCERT, Telangana, May 6, 2020
35. Indraveni K., "Online safety for Women", Online Session conducted by AP CID as part of Telangana eRakshabandhan, session through YouTube live, August 19, 2020.
36. Ch A S Murty, "Cyber Safety and Security", Generic Online Training in Cyber Security for Central Government Ministries/Departments, Online, March 25, 2021.
37. Ch A S Murty, "Cyber Security Governance and International law", ICFAI University Students, Online, March 12, 2021.
38. Ch A S Murty, "The Enterprise Cyber Security issues", Roundtable conference organized by The Indian Express, Online, February 24, 2021.
39. Ch A S Murty, "Cyber Safety and Security", Generic Online Training in Cyber Security for Central Government Ministries/Departments, February 17, 2021.
40. Ch A S Murty, "Cyber Crimes Against Women", Cyber Crimes Against Women in association with AP CID, Andhra Pradesh", Tirupati, January 6, 2021.
41. Ch A S Murty, "Cyber Safety and Security", Generic Online Training in Cyber Security for Central Government Ministries/Departments", January 5 and 21, 2021.
42. Ch A S Murty, "The Enterprise Cyber Security issues", Roundtable conference organized by The Indian Express, Online, January 22, 2021.
43. Ch A S Murty, "Open Source Cyber Security Tools & Technologies", Short Term Faculty Upgradation Program by IIIT, Bhubaneswar, Online, December 9, 2020.
44. Ch A S Murty, "Open-Source Cyber Security Tools & Technologies", Faculty of GIET University, Odisha, Online, December 12, 2020.
45. Ch A S Murty, "Open Source Cyber Security Tools & Technologies", Faculty of BITS, Ranchi, Online, December 13, 2020.
46. Ch A S Murty, "Cyber Safety and Security", Generic Online Training in Cyber Security for Central Government Ministries/Departments, December 2 and 16, 2020.
47. Ch A S Murty, "Open Source Cyber Security Tools & Technologies", Faculty of Guru Nanak Dev University, Jalandhar, Punjab, Online, November 10, 2020.
48. Ch A S Murty, "Open Source Cyber Security Tools & Technologies", Faculty of G B Pant University. Uttarakhand, Online, November 20 and 30, 2020.
49. Ch A S Murty, "Open Source Cyber Security Tools & Technologies", Faculty of JNU, Delhi, Online, November 26, 2020.
50. Ch A S Murty, "Open Source software Tools for Cyber Security", NIT, Patna Students, Online, October 6, 2020.
51. Ch A S Murty, "Open Source software Tools for Cyber Security", G B Pant Agri University, Online, October 10 and 12, 2020.
52. Ch A S Murty, Privacy, "Trust Management and Zero Trust Concept in IT", SBI Bank Employees, Online, September 1, 2020.
53. Ch A S Murty, "Cyber Crimes- punishments", In collaboration with AP CID as part of eRakshabandhan, YouTube Live, August 26, 2020.
54. Ch A S Murty, "What is considered Right and Wrong", Awareness week by women Safety Wing, Telangana police, Online, July 18, 2020.
55. Ch A S Murty, "Open Source Technologies", NIT, Jalandhar. Online, July 30, 2020.
56. Ch A S Murty, "Open Source Tools for Cyber Security", Global Webinar Series on Cyber Security, Online, June 23, 2020.
57. Ch A S Murty, "FDP on Cyber Security vulnerabilities and Security", FDP on Cyber Security vulnerabilities and security to faculties, Online, May 18-28, 2020.
58. Ch A S Murty, "Open-source technologies for Cyber Security", Collaboration with MNNIT, Allahabad, Online, May 30, 2020.

59. Ch A S Murty, "Social Networking and Fake messages", Teachers for Alwar, Rajasthan, Online, April 15, 2020
60. Ch A S Murty, "Social Networking and Fake Messages", BHEL Employees and family members, Online, April 18, 2020.
61. Ch A S Murty, "Online Teachers Training on Cyber Safety and Security", SCERT Telangana organize training programme as part of capacity building programme for teachers working in Government schools, Online, May 27-30, 2020.
62. Ch A S Murty, "Online Teachers Training on Cyber Safety and Security", Cyber Security Centre of Excellence (CS-CoE), West Bengal under the aegis of the Department of Information Technology & Electronics, Government of West Bengal, Online, July 14-17, 2020.
63. Ch A S Murty, "Online Teachers Training on Cyber Safety and Security", Rajasthan State institute Of Educational Research and Training, Rajasthan (R.S.I.E.R.T.) Udaipur, Online, January 7-8, 2021.
64. M. Kumar, "e-Learning", Workshop on Learning Online Tools, Institute of Science and Technology, JNTUH, Hyderabad, February 15, 2021.
65. M. Kumar, "Mobile Learning", Six Day Online Training Program on Inspirational Teaching, Learning & Research Methods – Online Educational Tools", Institute of Science and Technology, JNTUH, Hyderabad, March 24, 2021.
66. B. Vijayalakshmi, "Utility and demonstration of NMPB Helpline", Training on NMPB Helpline for Medicinal and Aromatic Plants Stakeholders of the country organized by National Medicinal Plants Board (NMPB), New Delhi, Online, Oct 19, 2020.
67. Asok Bandyopadhyay, "Preventive Vigilance in respect of e-Commerce transactions", One day training session on Preventive Vigilance for Mid-Career Level Executives of MSTC Limited, MSTC Head office, Kolkata, December 08, 2020.
68. Asok Bandyopadhyay, "Preventive Vigilance in respect of e-Commerce transactions", One day training session on Preventive Vigilance for Mid-Career Level Executives of MSTC Limited, MSTC Head office, Kolkata, 20.01.2021.
69. Asok Bandyopadhyay, "Introduction to Cyber Security and need of Cyber Security", Online Foundation Course on Cyber Security for the Govt. Officers under ISEA program of MeitY, Online (Virtual Instructor Led Training), March 1, 2021.
70. Anupam Chanda, "Network Security – Firewalls and overview of IDS/IPS/SIEM", Online Foundation Course on Cyber Security for the Govt. Officers under ISEA program of MeitY", Online (Virtual Instructor Led Training), March 03, 2021.
71. Anupam Chanda, "Topic-Introduction to Operating System – Windows and Linux", Online Foundation Course on Cyber Security for the Govt. Officers under ISEA program of MeitY, Online (Virtual Instructor Led Training), March 01, 2021.
72. Joyanta Basu, "AI in Speech Processing", Artificial Intelligence and its Application, Makaut, West Bengal, India, November 17, 2020.
73. Joyanta Basu, "Recent Research Trends in AI-ML Applications of Speech Processing", Recent Research Challenges in Computer Science and Applications, Kolkata, November 23, 2020.
74. Joyanta Basu, Ankur Ghoshal, "Artificial Intelligence (AI) / Machine Learning (ML) Using Python", 3rd One-week National Workshop on Emerging Tools and Technologies in Research (ETTR-2020), Tripura University, December 17, 2020.
75. Dr. Nabarun Bhattacharyya, "Application of ICT in Agriculture", International conference on Chemical and Environmental Sciences (ICCAES 2020), Online. Institute of Engineering & Management (IEM), Kolkata, December 18-20, 2020
76. Dr. Amitava Akuli, "Application of Artificial Intelligence (Computer Vision) in Agriculture", Workshop on Artificial Intelligence and its Application, C-DAC, Kolkata in collaboration with MAKAUT, West Bengal, Digital Platform, November 19, 2020.
77. Dr. Amitava Akuli, "Reimagining Careers Through Transition From Industry 4.0 to 5.0 – Opportunities and Challenges", Industry Conclave "ICON 21" organized by Narula Institute of Technology in collaboration with

Bengal Chamber of Commerce & Industry (BCC&I), Digital Webinar, February 26, 2021.

78. Alokesh Ghosh, "Precision Agriculture the future of farming", Webinar conducted by MAKAUT, Online Platform, March 24, 2021.
79. Dr. Mandeep Singh, "Automation and Robotics", ICTE sponsored Atal scheme "IoT, Robotics and UAV. Online Faculty Development program, October 12, 2020.
80. Rakesh Sehgal, Cyber Security, UGC sponsored refresher course of ICT, Himachal University, February 11, 2021
81. Rakesh Sehgal, "Big Data Techniques and It's applications, Big Data Management and Comprehensive analysis", DST Sponsored one week training program for Scientists and Engineers at C-DAC, Mohali, February 08, 2021.
82. Dr. Sukhmani, "Statistical approach towards data analysis with tools & techniques, Big Data Management and Comprehensive analysis", DST Sponsored one week training program for Scientists and Engineers at C-DAC, Mohali, February 9, 2021.
83. Anil Kumar, "Data Processing using Apache Hadoop, Big Data Management and Comprehensive analysis", DST Sponsored one week training program for Scientists and Engineers at C-DAC, Mohali, February 11, 2021.
84. Saurabh Chamotra, "Big Data Architecture & Design specification, Big Data Management and Comprehensive analysis", DST Sponsored one week training program for Scientists and Engineers at C-DAC, Mohali, February 11, 2021.
85. Dr. M. Sasikumar and Ms. Archana Rane, "Learning through Olabs", ICT webinar by CIET-NCERT, Online Mode, Youtube Live "NCERT Official", April 30, 2020.
86. Dr. M Sasikumar and Vaibhav Singh, "Learning Physics through Online Labs", ICT Webinar series organized by CIET NCERT, Online Mode Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch channel, March 8, 2021.
87. Archana Rane and Suman Ninoriya, "Learning Chemistry through Online Labs", ICT Webinar series organized by CIET NCERT, Online mode, Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch channel, March 9, 2021.
88. Vaibhav Singh and Prashant Chaubey, "Learning Maths through Online Labs", ICT Webinar series organized by CIET NCERT-Online Mode, Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch channel, March 10, 2021.
89. Suman Ninoriya and Priyanka Monde, "Learning Biology through Online Labs", ICT Webinar series organized by CIET NCERT, Online Mode Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch channel, March 11, 2021.
90. Vaibhav Singh and Suman Ninoriya, "ओलैब्स, ऑनलाइन प्रयोगशाला-एक परिचय", ICT Webinar series organized by CIET NCERT, Online Mode Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch channel, March 12, 2021.
91. Kapil Kant Kamal, "Transforming Governance in States with Digital Connect- Governance Now", Tech Masterclass for State Governments, Online, September 24, 2020.
92. Ashu Krishna, "Shortest Food Supply Value Chain Management: Opportunities and Challenges", Post COVID-19 sustainable Uttar Pradesh 2025 organized by CADMS and CFAM, AIRMEET (Virtual Event), January 11, 2021.
93. Praveen Kumar Srivastava, "CIMS-Global Healthcare Virtual Summit on Digital Health", CIMS Medica, Online, August 8, 2020.
94. Amarjeet Singh Cheema, "Cloud adoption in Indian healthcare", ACCESS Health Digital, Online, July 28, 2021.
95. Amarjeet Singh Cheema, "Discussion on Sustainable Healthcare Systems in India", Ernst & Young LLP, Online, June 12, 2021.
96. Siddharth Srivastava, "Failing at AI", NYU AI School, New York University, USA (Online), January 6, 2021.
97. Siddharth Srivastava, "AI and Blockchain for Health Informatics", ATAL FDP on Blockchain, Amity University (Online), December 7, 2020.
98. Siddharth Srivastava, "Learning Descriptors from 2D and 3D Visual Inputs and applications", ATAL FDP on

Data Science and Machine Learning, KIET (Online), November 18, 2020.

99. V. K. Sharma, "Cyber Space Issues & Capacity Building", International Conference on Cyber Law, Cyber Crime & Cyber Security (ICCC), Online, November 27, 2020.
100. Dr Arti Noor, "Data Science: Importance and Application in today's scenario", AICTE sponsored one-week STTP on Data Science, Online, August 24, 2020.
101. Dr Arti Noor, "Current Trends and Challenges in VLSI Design", AICTE sponsored FDP on TCAD Simulation of Microelectronic Devices beyond 2020, J.C. Bose University of Science and Technology, YMCA Faridabad, Online, November 23, 2020.
102. Lakshmi Kalyani, "Tackling Cyber space issues with Capacity Building", International Conference on Cyber Law, Cyber Crime & Cyber Security (ICCC), Online, November 2020.
103. Sajeevan G, "Web GIS Application for Indian Prime Minister's Rural Road Programme", Maps for the Web, W3C/OGC workshop, Online, September 28, 2020
104. Dr. Binay Kumar, "C-DAC's contribution in Remote Sensing and GIS Techniques and demo of the various applications/solutions of C-DAC developed using Remote Sensing/GIS techniques", Induction Course for University Students, SP Pune University (through VC), February 19, 2021.
105. Asima Mishra, "Challenges and Opportunities for Women in Geospatial World in Today's Context", International Women's Day 2021, Indian Institute of Remote Sensing, ISRO, Dehradun, Online (IIRS Youtube channel), March 08, 2021.
106. Sajeevan G, "Research Avenues in Geoinformatics", Webinar by VIT-AP, Online, March 10, 2021.
107. Dr. V. Sivakumar, "Research avenues in remote sensing and Geo-informatics", Webinar organized by VTP-AP university, Online, March 10, 2021.
108. Sandeep Kumar Srivastava, "Geospatial Technologies and Governance", International webinar on 'Spatial Intelligence for Real-World Solutions, Symbiosis Institute of Geoinformatics (through VC), September 17, 2020.
109. Ashish Kuvelkar, "IoT Sensors and IoT Interfaces", ATAL FDP on IOT, IIT Goa, Online, November 15, 2020.
110. Samrit Kumar Maity, "Emergence of new age supercomputing - Platform, Applications and Domains", PICT IEEE Student Branch and IEEE Computer Society Pune Chapter, Online, November 28, 2020.
111. Samrit Kumar Maity, "Emergence of new age supercomputing - Platform, Applications and Domains", PICT IEEE Student Branch and IEEE Computer Society Pune Chapter, Online, November 28, 2020.
112. Yumnam Kirani Singh, "N-Bit Logic Algebra", N-Bit Logic Algebra for students and Research Scholars, NIT Silchar, Electronics and Computer Science Engineering Department, Online (Webex Link), October 10, 2020.
113. Yumnam Kirani Singh, "Introduction to Python Programming", AICTE Training and Learning (ATAL) Academy Online Faculty Development Programme on "Role of Artificial Intelligence in Science and Engineering Applications (RAISEA-2020) for CBSE School Teachers, Online (Webex Link), October 29, 2020.
114. Yumnam Kirani Singh, "Advanced Python Programming", Python Training Programs for POSOCO Staffs, Shillong, Online (Webex Link), March 18, 19, 22 and 23, 2021.
115. Senthilkumar K B, SOC Challenges – Is ML the panacea?, One week ATAL AICTE Approved Online FDP on "Cyber security using ML-Practical Applications", Dr. MGR Educational & Research Institute, Chennai, January 5, 2021
116. Dittin Andrews, "Cyber Security Challenges during Covid 19 Pandemic", Online Conference conducted by ASAP, Department of Higher Education Government of Kerala, Online, May 21, 2020.
117. Dittin Andrews, "Reconnaissance techniques in Information Security", Workshop on Cyber Crime Investigation and Cyber Forensics, Kerala Police Training Academy, July 2, 2020.
118. Dittin Andrews, "Cyber Security in Every Day Life", National Cyber Security Day Celebrations Government of Kerala", Government Secretariat-Kerala, October 9, 2020.
119. Dittin Andrews, "Child internet Security issues -Before Pandemic and During Pandemic", Webinar Series Conducted by Kerala Vocational Higher Secondary education, MTVHSS, February 23, 2021.
120. Satheesh Kumar S, "Smartphone Forensics – Procedures and Techniques", Training programme for Special Branch Officers, Kerala Police at Intelligence Training School, SAP Camp, Trivandrum, February 14, 2020.

121. Satheesh Kumar S, "Security and Forensics in Smartphones", raining programme for Officers of DoT, IISc Bangalore, Online, February 3, 2021.
122. Satheesh Kumar S, "Cybercrimes and Forensics", Expert interaction session on with students of VSVHSS, Ezhukone, Kollam, Online, March 16, 2021.
123. Sreenadh S., "Software development for 64-bit RISC-V processor verification", RISC-V Global Forum, Virtual event, September 3, 2020.
124. Jayan V., "Vaccination Drive and Cyber Threats in India", International Conference on Theory and Practice of Electronic Governance (ICEGOV 2020), Online (Athens Greece), September 24, 2020.
125. Jayan V., "Health Fear Mongering Make People more Sicker: Twitter Analysis in the context of Corona Virus Infection", IFIP WG 8.6 Conference 2020, Online (IIM Trichy), December 17, 2020.
126. Jayan V., "Machine Translation for Indian Languages: Challenges and Opportunities", Three-Day International Webinar on Language, Data, and Knowledge Extraction, Kerala University, Karyavattom, Trivandrum, March 23, 2021.
127. Priya P. Sajan, "Awareness on Cyber Security", Tech Talk Series organized by Government Engineering College, Palakkad, Online, February 22, 2021
128. Sajini T, "Judging panel for Communications project, screening and final selection", All India Level Competition, IEEE Communication Project Competition 2020, IEEE ComSoc Kerala Chapter (Online), April 24, 2021.
129. Balan C., "Cyber Forensics and Challenges", Faculty Development Programme organised by Government Engineering College, Palakkad, Online, August 1, 2020.
130. Balan C., "Cyber Forensics and C-DAC solutions", Tech Talk Series organised by Noorul Islam University, Thuckalay, Online, July 6, 2020.
131. Jayaram Peggem, "Real Time Threat detection and Mitigation techniques", Five Day Online National Level Short-Term Program on Cyber Attack Detection and Mitigation Techniques conducted by CySeck Govt of Karnataka and NIT Surathkal, Online, July 29, 2020.
132. Jayaram Peggem, "Cyber Forensics Analysis", Five Day Online National Level Short-Term Program on Cyber Attack Detection and Mitigation Techniques conducted by CySeck Govt of Karnataka and NIT Surathkal, Online, July 30, 2020.
133. Prakash R., "Applications of the intelligent transportation system (ITS)", Industrial Lecture series, IIT Hyderabad online mode, February 22, 2021.
134. Ramesh P., "Development of Hybrid Power Conditioning System for remote micro grid environment", Uk-India Joint Virtual Clean Energy Centre Conference, Online, September 21, 2020.
135. Saravana Kumar A., "Multilevel Converter for Grid Interactive PQ Improvement System", NaMPET-3 Short term course, IIT Roorkee, December 5, 2020.
136. Brijesh P., "Microgrid for Remote Village - A Case study", Transition in Power Electronics towards Sustainable, Smart and Flexible Micro-grids, NIT Delhi, October 19, 2020.
137. Jiju K., "The Smart Meter Technology", One Day National Seminar on Smart Meter testing qualification, CPRI, Bangalore, February 20, 2021.

Human Resource Development

HRD team in C-DAC formulates HR policies in line with the organization's vision. HRD ensured that the right facilitation is extended to the core functions to meet their goals in the interest of the organisation and that of the Nation at large.

HRD, being one of the most sought-after internal service provider and strategic partner, strives to support the organization in its meaningful sustenance and qualitative growth. C-DAC being an organization built upon its knowledge base and innovation capabilities drive its success through the competency of its employees, deriving synergic collaboration across all corners of C-DAC and outside. The HRD function takes a queue from this insight and delivers quality services to its stake holders

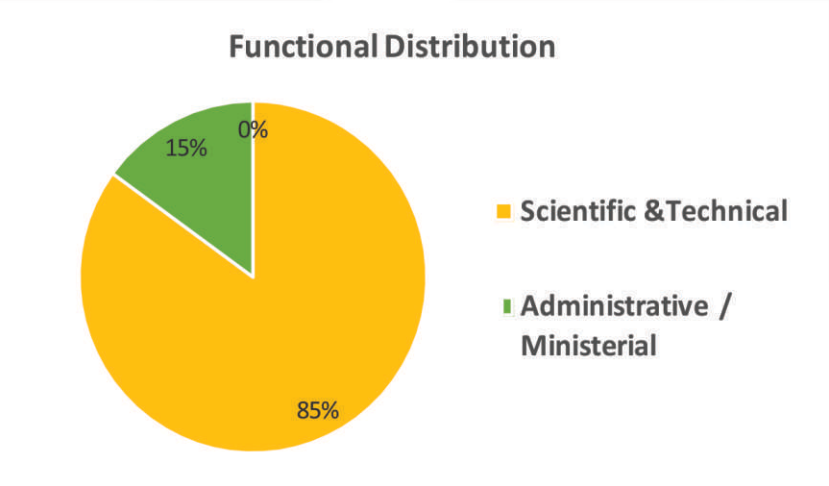
Accomplishments and Initiatives during the year 2020 – 21

1. **Centralised Training for S&T members and Non S&T members** – Continuous development of Human Resources fostering their engagement by imparting training to employees both S&T and Non S&T. Imparted 3270 man-days of training during the year.
2. **CAKES**: 4 No. of SLICEs completed imparting 2206 man-days of training through the platform.
3. **Leadership Coaching** – One on one leadership coaching programme as a progressive enhancement tool for identified competencies. 20 handpicked positive leaders formed the pilot batch. These leaders participated in a 2 day Assessment Center and based on the outcome, the individual leader decided on 2-3 competencies, in which he/she will undergo coaching.
4. **Online APAR system** – For improved transparency and to streamline the filling of APAR form, reporting of entries, record keeping and retrieval of entries, C-DAC has adopted the online APAR system. For filling the APAR online, employees have to access the online system by logging into apar.cdac.in through C-DAC Single Sign On (SSO) service.
5. **HR Handbook -** A need for notifying a comprehensive handbook was identified for better employment administration and increased awareness among employees. Towards this need, a drafting committee was constituted by Director (HRD) to prepare Handbook. The Handbook was released on 15th August 2020 by the hands of Director General and is made available to the employees of C-DAC through the iHRMS.
6. **C-DAC Adjunct Engineer Scheme (CAE) -**The scheme is carved out to identify motivated and experienced industry driven engineers for bringing in process driven product and services approach along with research in C-DAC's interest areas for achieving the following broad goals:
   i. To enhance the productization and competitive delivery capabilities of C-DAC.
   ii. To enhance the industry – connect for synergic collaborations.
   iii. To bring in increased competitiveness in C-DAC activities.
   iv. Encouraging commercial approach in project delivery.
   v. Enhance C-DAC's visibility to industry and vice-versa
7. **C-DAC internship scheme** – C-DAC Internship scheme was notified with the objective to allow young talent from institutes of national repute and C-DAC's own institutes, to be associated with C-DAC from the R&D perspective and promote innovation factor in the projects undertaken. 23 students from institutes falling in top 50 ranks in NIRF ranking and Govt. institutions of North East Region (NER) were inducted for internship for a duration of 6 months/1 year, in 2021-21.

Manpower Distribution

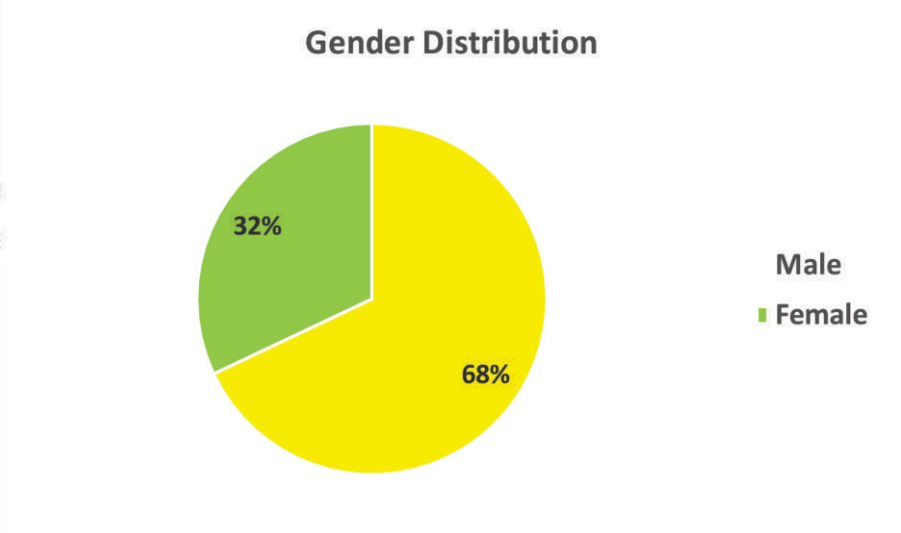
Functional Distribution –

C-DAC has 3115 employees as on March 2021, spread across 12 centres and Corporate Office. The functional composition of the workforce is as shown below:



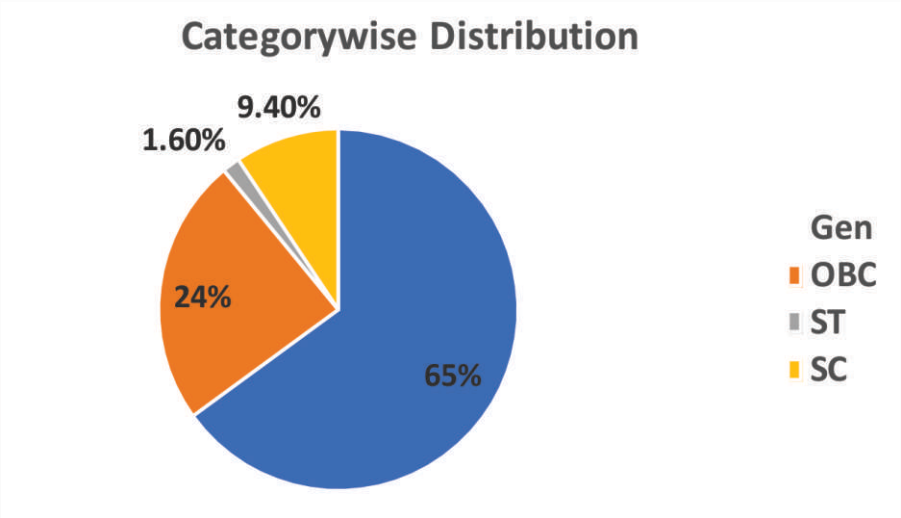
Gender Distribution –

C-DAC has been paying due attention to gender equality in employment. Female employees account for 32 percent of the total C-DAC workforce which is higher than national average in the sector. The proportion of women in the senior executive positions also is encouraging in C-DAC.



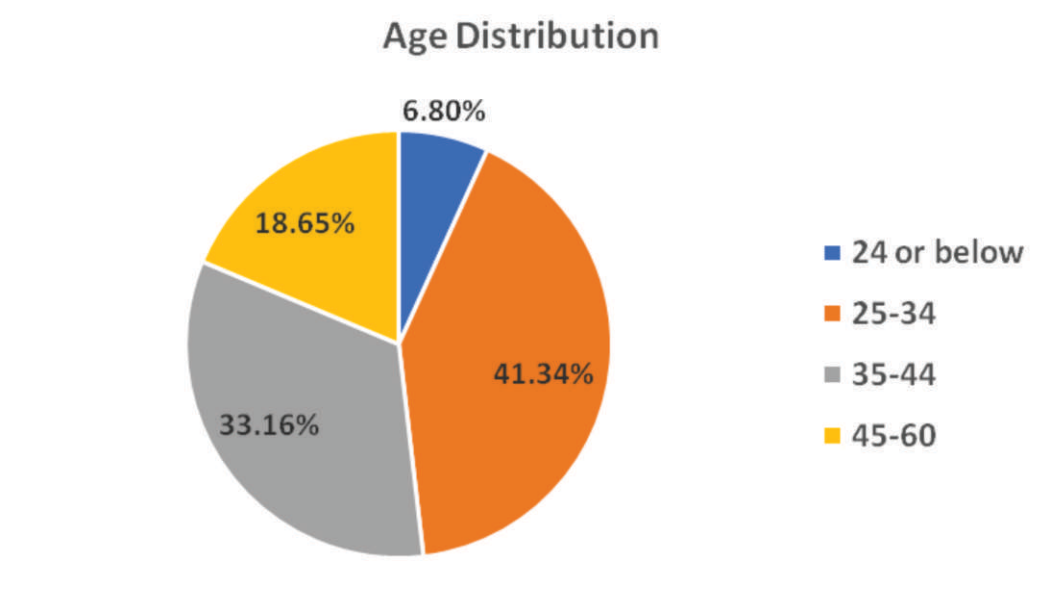
Category Distribution –

As a law-abiding model employer, C-DAC has ensured adequate representation of Scheduled Caste (SC), Scheduled Tribes (ST) and OBC members. C-DAC obliges the national priority in fair terms and has significant representation of the reserved categories. It is pertinent to note that Group A S&T positions are exempted from the purview of reservation orders.



Age Distribution –

Since C-DAC always retained itself in the growth and expanding track, it retains an impressive age distribution among its employees. 48 percent of the employees are below the age of 35 years.



Legal

The C-DAC Legal Department renders effective legal Advice in defending cases, reports and correspondence, drafting reply, review of legal documents, as required from time to time.
The Department advise in the matter of preferring of appeals in the various Courts and Tribunals, taking recourse to other legal remedies.
Key Activities are as follows:

- All centres of C-DAC and Corporate office has a Legal cell, which take up all the Legal issues relating to employees of C-DAC, vendor and other parties.
- During the financial year (April 20 – March 21) approx. 8 court cases were dealt at various CATs, High Courts, Tribunals, Courts and Arbitrators etc. These cases are mostly related to service matters of C-DAC centres.
- In addition to above, Legal Cell also draft/vetted various MoUs / Agreements to be signed with various stake holders. During the year (April 20 – March 21), approx. 197 MoUs / Agreements were vetted / drafted by Legal Cell.
- Corporate Legal Cell coordinates with MeitY, Advocates and Centres for the court cases and provides valuable inputs supported by relevant judgments pronounced by various courts of India.

RTI

C-DAC is a Public Authority 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 portal rtionline.gov.in. Mandatory disclosures as per the guidelines of section Sec 4(1)(b) have been published in the RTI module on C-DAC's website. The same is updated on monthly basis.

During the financial year 2020-21, total 1097 applications were received which were duly processed.

Details related to the Vigilance Cases

During the year 2020-21, 6 complaints have been disposed off and 1 complaint is under investigations. These complaints were mainly related to misconduct, irregularities of tender process, Irregularities of appointments and outsourcing of faculty positions.

Other Activities

In the year 2020, as per the guidelines of the Central Vigilance Commission, Vigilance Awareness Week was observed in all CDAC centre from 27th October to 2nd November 2020. During this Week 1050 employees, 355 customers and 17 citizens have taken integrity pledge on the theme of "Vigilant India and Prosperous India" (Satark Bharat, Samriddh Bharat) and also online pledge through the website "https://pledge.cvc.nic.in/" hosted by Central Vigilance Commission. All C-DAC Centre have organized the Vigilance Awareness Week by conducting activities e.g. Essay writing, On-line quizzes, Short video and various seminars/workshops.

On 27th October, 2020 Smt. Sunita Verma, Scientist 'G' MeitY and CVO C-DAC launch the website https://vcs.cdac.in along with Col. A.K. Nath, Executive Director, C-DAC, Pune, Shri Rai Varghese, Director (HR) Corporate, Shri Vinodh Kumar, HoD I&E C-DAC Pune, Shri V.K. Sharma Vigilance Officer, C-DAC.

A talk on theme "Preventive Vigilance: A tool to minimize Corruption " was conducted on 29th October 2020 from 11.00 am to 1.00 pm. by Shri Mukesh Chaturvedi, Director (DoPT) Retd. where in employees from all C-DAC centre have participated.

Also a talk on theme "Satark Bharat, Samriddh Bharat (Vigilant India, Prosperous India)" was conducted on 2nd Nov., 2020 by Padma Shri M.C. Dathan ,Scientific Advisor, Govt. of Kerala through video conferencing, total 150 officials from C-DAC centres have attended this session.

Financials

LAHOTI KASAT & CO.

CHARTERED ACCOUNTANTS

Head Office :
204, 2nd Floor, P.J.Chamber,
Pimpri, Pune 411018.

Branch Office :
- 11, Bhor, Ganesh Baug Society, Batwadi, Ram Joshi Marg, Ghatkopar, (W) Mumbai 400084.
- 8th Lane, Pitaman Building, Opp. Maheshwari Bhavan, Jaysinghpur, Kolhapur - 416 101
- Jamuna Building, Near Balaji Mandir, Latur - 413512
- Somani Complex, Near Hanuman Temple, Old Mondha, Nanded - 431604

Email id : cpkca@rediffmail.com, carohitkasat@gmail.com
Mobile : 9822047548 / 9766145457 Office (020) 27423696

Ref. No Date :

INDEPENDENT AUDITOR'S REPORT

To,
The Members,
Center for Development of Advance Computing,
C-DAC Innovation Park, 2nd Floor, Panchavati,
Pashan, Pune-411008

Report on the Consolidated Financial Statements

Opinion

We have audited the accompanying Consolidated Financial Statements of **Center For Development of Advance Computing, (C-DAC),** (Hereafter referred as "C-DAC ") which comprise the consolidated Balance sheet as at March 31, 2021 and the consolidated Income and Expenditure Account and consolidated Receipts and Payments Accounts for the year then ended, and summary of significant accounting policies and other explanatory information (hereinafter referred to as "the consolidated financial statements") in which are incorporated the accounts for the year ended on that date audited by the Centre's auditors of the Centre's of the C-DAC located at (Bengaluru, Chennai, Corporate Office, Delhi, Hyderabad, Kolkata, Mohali, Mumbai, Noida, Patna, Pune and Thiruvananthapuram).

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid consolidated financial statements give the information in the manner so required to the extent applicable and give true and fair view in conformity with the accounting principles generally accepted in India, of the state of affairs of the Center as at 31st March, 2021, and its consolidated surplus and its consolidated receipts and payments for the year ended on that date.

Basis for Opinion

We conducted audit in accordance with standards on auditing issued by institute of Chartered Accountants of India. Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Consolidated Financial Statements section of our report. We are independent of the Center in accordance with the Code of Ethics issued by the Institute of Chartered Accountants of India (ICAI) together with the independence requirements that are relevant to our audit of the consolidated financial statements under the

provisions of the Act and the Rules made there under, and we have fulfilled our other ethical responsibilities in accordance with these requirements and the ICAI's Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion on the consolidated financial statements.

Management's Responsibility for the Financial Statements

The Center's 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 payments of the C-DAC in accordance with the accounting principal generally accepted in India.

The management of the Centre's of C-DAC is responsible for the maintenance of adequate accounting records, safeguarding the assets of the Center, for preventing and detecting frauds and other irregularities, selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, 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.

In preparing the consolidated financial statements, the management of the Centre's of C-DAC is responsible for assessing the Center ability to continue as a going concern and using the going concern basis of accounting unless management either intends to liquidate the Centre's of C-DAC or to cease operations, or has no realistic alternative but to do so.

The management of the Centre's of C-DAC is also responsible for overseeing the financial reporting process of the Center's of C-DAC.

Auditor's Responsibilities for the Audit of the Consolidated Financial Statements

Our objectives are to obtain reasonable assurance about whether the consolidated financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Standard on Auditing (referred as SAs) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidated financial statements.

As part of an audit in accordance with SAs, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the consolidated financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that Is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal controls.

- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the ability of the Center to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the consolidated financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's However, future events or conditions may cause the Center to cease to continue as a going concern.

- Evaluate the overall presentation, structure and content of the consolidated financial statements, including the disclosures, and whether the consolidated financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

- Obtain sufficient appropriate audit evidence regarding the consolidated financial information of the entities or business activities within the Center to express an opinion on the financial statements. We are responsible for the direction, supervision and performance of the audit of the consolidated financial statements.

Materiality is the magnitude of misstatements in the consolidated financial statements that, individually or in aggregate, makes it probable that the economic decisions of a reasonably knowledgeable user of the financial statements may be influenced. We consider quantitative materiality and qualitative factors in (I) planning the scope of our audit work and In evaluating the results of our work; and (ii) to evaluate the effect of any identified misstatements in the consolidated financial statements.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

Report on Other Requirements

Based on our audit and on the consideration of the report of the center auditors on separate financial statements, referred in the other Matters paragraph above we report, to the extent applicable, that:

a. We have sought and obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purposes of our audit of the aforesaid consolidated financial statements

b. In our opinion, proper books of account relating to preparation of the aforesaid consolidated financial statements have been kept so far as it-appears from our examination of those books.

c. The Consolidated Balance sheet, the Consolidated Income and Expenditure Account and Consolidated Receipts and payments Accounts Statement dealt with by this Report are in agreement with the relevant books of account maintained by the center.

d. Reporting on the adequacy of Internal Financial control over Financial Reporting of the C-DAC and the operating effectiveness of such controls, is not applicable,

e. With respect to the emphasis of matter included in the Auditor's Report, in our opinion and to the best of our information and according to the explanations given to us:

i. The consolidated financial statements disclose the impact of pending litigations on the financial position of the C-DAC.

ii. The C-DAC did not have any material foreseeable losses on long-term contracts including derivative contracts.

iii. There were no amounts which were required to be transferred to the Investor Education and protection Fund by the C-DAC and its Centre's incorporated in India.

For M/s. Lahoti Kasat & Co. (FRN: 105509W)
Chartered Accountants

CA Rohit Kasat
Partner (Membership No. 151410)
UDIN : 21151410AAAADV4397
Place: Pune
Date: 30th October 2021.

CONSOLIDATED BALANCE SHEET AS AT 31st March 2021

Amount in ₹

Particulars	Schedule	2020-21	2019-20
CORPUS/CAPITAL FUND AND LIABILITIES			
Corpus/Capital Fund	1	4,38,36,31,364	3,79,25,43,494
Reserves and Surplus	2	3,12,87,42,898	2,55,92,70,364
Earmarked and Endowment Funds	3	9,19,99,18,791	7,91,85,15,220
Secured Loan from Bank		-	-
Current Liabilities and Provisions	4	4,87,97,16,596	4,62,09,82,956
Branch & Divisions		-	-
Total		**21,59,20,09,649**	**18,89,13,12,034**
ASSETS			
Fixed Assets			
Acquired out of Own Funds	5	36,46,97,358	35,56,93,018
Acquired out of Grant in Aid	6	1,89,80,02,108	1,91,50,31,242
Acquired out of Project Grants	7	1,23,07,40,791	64,42,39,123
Investments-Others		5,05,000	5,05,000
Current Assets, Loans & Advances	8	18,09,80,64,392	15,97,58,43,651
Miscellaneous Expenditure		-	-
Total		**21,59,20,09,649**	**18,89,13,12,034**
		-	-
Summary of significant accounting policies	17		
See accompanying notes forming part of financial statements	18		

Indira Pasupathy
Director Finance

Sunil Misar
Registrar (I/C)

Col. A. K. Nath (Retd.)
Director General (I/C)

AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
M/S. Lahoti Kasat & Co. (FRN: 105509W)
CHARTERED ACCOUNTANTS

CA Rohit Kasat
Partner (M.No.151410)
UDIN : 21151410AAAADV4397
Place : Pune , Date : 30-Oct-2021

Consolidated Income and Expenditure Account for the year ending 31st March 2021

Amount in ₹

Particulars	Schedule	2020-21	2019-20
INCOME			
Income from Sales/Services	9	3,14,64,04,580	3,16,42,14,393
Grants/Subsidies	10	1,33,44,52,138	1,19,27,17,956
Fees/Subscription	11	20,48,36,390	91,45,07,007
Interest Earned	12	28,99,48,114	25,19,32,428
Other Income	13	1,53,71,951	51,92,619
Prior Period Income		4,76,189	2,16,63,592
Increase/(decrease) in stock of Finished Goods and Work-in-progress	14	(12,11,49,974)	48,03,49,989
TOTAL (A)		**4,87,03,39,388**	**6,03,05,77,984**
EXPENDITURE			
Establishment Expenses	15	2,83,75,69,662	2,89,09,22,433
Other Administrative Expenses	16	1,38,38,66,537	2,48,78,91,592
Prior Period Expenses		(6,55,88,863)	26,18,659
Depreciation (corresponding to Schedule 5)		5,12,68,531	4,81,11,112
TOTAL (B)		**4,20,71,15,867**	**5,42,95,43,796**
Transferred to / (from) Balance of Mission Grants		7,21,35,651	-
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CORPUS/CAPITAL FUND		**59,10,87,870**	**60,10,34,188**
Summary of significant accounting policies	17		
See accompanying notes forming part of financial statements	18		

Indira Pasupathy
Director Finance

Sunil Misar
Registrar (I/C)

Col. A. K. Nath (Retd.)
Director General (I/C)

AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
M/S. Lahoti Kasat & Co. (FRN: 105509W)
CHARTERED ACCOUNTANTS

CA Rohit Kasat
Partner (M.No.151410)
UDIN : 21151410AAAADV4397
Place : Pune , Date : 30-Oct-2021

Amount in ₹

Particulars	2020-21	2019-20
Schedule 1 - Corpus/Capital Fund		
Balance as at the beginning of the year	3,79,25,43,494	3,20,56,98,850
Add: Surplus as per Income & Expenditure Account	59,10,87,870	60,10,34,188
Less : Own contribution to Core / Projects and Other Adjustments / Transfers	-	1,41,89,544
Less : Corporate Office Contribution	-	-
Balance as at the year - end	**4,38,36,31,364**	**3,79,25,43,494**
Schedule 2 - Reserves and Surplus		
1. Capital Reserve :		
As per last Account	2,55,92,70,364	2,72,69,16,043
Addition during the year	1,19,85,89,777	7,75,18,913
Less : Deductions during the year	62,91,17,243	24,51,64,592
Total	**3,12,87,42,898**	**2,55,92,70,364**
Schedule 3 - Earmarked/Endowment Funds		
1. Balance of Core Grants		
a) Opening balance of the funds	-	-
b) Additions to the Funds		
I) Donations/Grants	1,25,00,00,000	1,20,00,00,000
II) Income from Investments made on account of funds	-	-
III) Other additions (C-DAC Contribution and Other Income)	9,96,31,655	68,258
Total (b)	1,34,96,31,655	1,20,00,68,258
Total (a)+(b)	1,34,96,31,655	1,20,00,68,258
c) Utilization/Expenditure towards objectives of funds		
I) Capital Expenditure		
Fixed Assets	1,52,70,186	73,18,974
Others	-	-
Total I	1,52,70,186	73,18,974
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	1,21,12,72,375	1,16,40,34,424
Componants, Consumables and Other Direct Expenses	19,17,964	8,85,748
Travel	20,92,890	39,40,425
Contingencies, Overheads and Other Administrative Expenditure	5,08,52,369	2,38,88,688
Total II	1,26,61,35,598	1,19,27,49,284
Total (c)	1,28,14,05,784	1,20,00,68,258
Net Balance as at Year - End (a+b-c) Total 1	6,82,25,871	-
Projects wise Allocated Core Grant Projects (Details as per Annexure 1)		
d) Opening balance	(21,88,62,920)	(23,27,02,736)
e) Additions to the Funds		
I) Donations/Grants	2,00,00,000	-
II) Income from Investments made on account of	-	-
III) Other additions (C-DAC Contribution and Other	2,30,73,792	3,69,87,781
Total (e)	4,30,73,792	3,69,87,781
Total (d)+(e)	(17,57,89,128)	(19,57,14,955)

Amount in ₹

Particulars	2020-21	2019-20
f) Utilization/Expenditure towards objectives of		
I) Capital Expenditure		
Fixed Assets	-	1,97,74,965
Others	-	-
Total I	-	1,97,74,965
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	-	-
Componants, Consumables and Other Direct Expenses	-	-
Travel	-	-
Contingencies, Overheads and Other Administrative Expenditure	-	-
Total II	-	-
Total Expenditure (f)	-	1,97,74,965
g) Refund / Transfer and Other Adjustments	-	33,73,000
Net Balance as at Year - End (d+e-f-g) Total 2	(17,57,89,128)	(21,88,62,920)
Core Grant Balance as at Year - End (Total 1 + Total 2) Total 3	(10,75,63,257)	(21,88,62,920)
2. Grants for Funded Projects (Details as per Annexure 2)		
a) Opening balance of the funds	8,13,15,25,554	2,72,46,71,708
b) Additions to the Funds		
I) Donations/Grants	5,69,43,63,226	8,71,29,62,781
II) Income from Investments made on account of funds	37,62,96,282	28,02,90,510
III) Other additions (C-DAC Contribution and Other Income)	15,58,41,524	9,47,77,692
Total (b)	6,22,65,01,032	9,08,80,30,983
Total (a)+(b)	14,35,80,26,586	11,81,27,02,691
c) Utilization/Expenditure towards objectives of funds		
I) Capital Expenditure		
Fixed Assets	1,18,83,33,508	23,35,98,315
Others	-	-
Total I	1,18,83,33,508	23,35,98,315
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	1,18,33,87,898	99,87,76,513
Componants, Consumables and Other Direct Expenses	1,88,81,15,857	1,83,22,29,045
Travel	2,00,31,084	6,76,24,193
Contingencies, Overheads and Other Administrative Expenditure	46,05,78,430	34,88,61,246
Total II	3,55,21,13,269	3,24,74,90,997
Total (c)	4,74,04,46,777	3,48,10,89,312
d) Refund / Transfer and Other Adjustments	31,61,00,662	20,00,87,825
Net Balance as at Year - End (a+b-c-d) Total 4	9,30,14,79,147	8,13,15,25,554
3. Employee and Other Funds:		
As per last Account	58,52,587	58,84,204
Addition during the year	1,50,315	1,47,560
Less : Deductions during the year	-	1,79,177
Total (5)	60,02,902	58,52,587
Grand Total (Total 3+ Total 4+Total 5)	**9,19,99,18,791**	**7,91,85,15,220**

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	Building Fund	(21,88,62,920)	2,00,00,000	-	2,30,73,792	-	-	-	-	-	-	-	(17,57,89,128)
2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**(21,88,62,920)**	**2,00,00,000**	**-**	**2,30,73,792**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**(17,57,89,128)**

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**												
	MeitY Projects	3,30,95,116	11,81,18,251	8,90,988	15,500	96,50,395	3,37,90,105	34,85,440	4,42,908	1,31,51,573	6,05,20,421	2,21,842	9,13,77,592
	Other Agency Projects	(3,62,216)	4,54,10,000	3,00,165	-	1,67,219	82,21,385	76,81,559	-	10,68,738	1,71,38,901	18,679	2,81,90,369
	Total Bangalore Centre	3,27,32,900	16,35,28,251	11,91,153	15,500	98,17,614	4,20,11,490	1,11,66,999	4,42,908	1,42,20,311	7,76,59,322	2,40,521	11,95,67,961
2	**Chennai Centre**												
	MeitY Projects	2,12,74,363	40,00,000	2,76,697	1,00,000	34,20,027	1,55,50,351	18,76,511	3,02,598	22,04,047	2,33,53,534	22,68,175	29,351
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Chennai Centre	2,12,74,363	40,00,000	2,76,697	1,00,000	34,20,027	1,55,50,351	18,76,511	3,02,598	22,04,047	2,33,53,534	22,68,175	29,351
3	**Corporate Office**												
	MeitY Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Other Agency Projects	8,81,94,561	(8,70,00,000)	(11,94,561)	-	-	-	-	-	-	-	-	-
	Total Corporate Office	8,81,94,561	(8,70,00,000)	(11,94,561)	-	-	-	-	-	-	-	-	-
4	**Delhi Centre**												
	MeitY Projects	1,46,57,872	1,45,64,298	2,53,721	-	-	1,22,85,279	8,08,428	3,15,295	9,77,347	1,43,86,349	3,04,219	1,47,85,323
	Other Agency Projects	15,70,81,743	15,32,54,309	2,291	5,19,416	-	4,44,85,054	8,16,25,995	1,48,138	16,23,430	12,78,82,617	-	18,29,75,142
	Total Delhi Centre	17,17,39,615	16,78,18,607	2,56,012	5,19,416	-	5,67,70,333	8,24,34,423	4,63,433	26,00,777	14,22,68,966	3,04,219	19,77,60,465
5	**Hyderabad Centre**												
	MeitY Projects	27,08,00,240	31,62,65,000	1,14,72,266	1,10,42,608	44,29,087	4,80,83,173	24,72,143	7,20,785	2,02,23,703	7,59,28,891	22,33,16,307	31,03,34,917
	Other Agency Projects	10,20,01,385	8,94,11,800	19,08,503	-	4,76,17,600	3,80,97,514	7,01,063	5,12,696	6,06,547	8,75,35,420	3,60,664	10,54,25,604
	Total Hyderabad Centre	37,28,01,625	40,56,76,800	1,33,80,769	1,10,42,608	5,20,46,687	8,61,80,687	31,73,206	12,33,481	2,08,30,250	16,34,64,311	22,36,76,971	41,57,60,521
6	**Kolkata Centre**												
	MeitY Projects	6,84,14,437	7,14,67,000	11,09,799	-	54,08,004	4,59,54,755	1,60,10,963	35,13,960	2,20,05,646	9,28,93,328	22,95,906	4,58,02,003
	Other Agency Projects	6,19,82,014	1,42,98,870	7,050	-	19,45,597	1,08,07,941	2,26,21,923	7,29,698	48,44,200	4,09,49,359	81,47,655	2,71,90,920
	Total Kolkata Centre	13,03,96,451	8,57,65,870	11,16,849	-	73,53,601	5,67,62,696	3,86,32,886	42,43,658	2,68,49,846	13,38,42,687	1,04,43,561	7,29,92,923
7	**Mohali Centre**												
	MeitY Projects	1,41,69,799	2,00,89,000	6,43,966	-	86,91,197	1,83,79,185	13,32,891	1,09,515	47,55,523	3,32,68,311	18,05,115	(1,70,661)
	Other Agency Projects	10,22,24,829	2,38,97,692	44,34,628	-	18,82,760	3,68,54,528	6,48,063	85,252	2,11,40,820	6,06,11,423	9,06,024	6,90,39,702
	Total Mohali Centre	11,63,94,628	4,39,86,692	50,78,594	-	1,05,73,957	5,52,33,713	19,80,954	1,94,767	2,58,96,343	9,38,79,734	27,11,139	6,88,69,041
8	**Mumbai Centre**												
	MeitY Projects	11,76,899	13,57,68,000	11,18,000	-	1,29,75,190	3,04,42,537	1,74,68,074	2,03,950	14,27,563	6,25,17,314	99,39,820	6,56,05,765
	Other Agency Projects	(3,26,429)	-	-	-	-	-	6,15,461	-	-	6,15,461	-	(9,41,890)
	Total Mumbai Centre	8,50,470	13,57,68,000	11,18,000	-	1,29,75,190	3,04,42,537	1,80,83,535	2,03,950	14,27,563	6,31,32,775	99,39,820	6,46,63,875
9	**Noida Centre**												
	MeitY Projects	54,60,94,350	91,12,63,100	1,31,66,828	-	1,98,70,245	17,91,25,707	27,56,69,912	63,78,980	1,35,34,958	49,45,79,802	90,50,444	96,68,94,032
	Other Agency Projects	6,87,585	8,10,43,811	10,82,000	-	5,00,439	2,98,81,583	21,33,714	26,445	1,02,34,906	4,27,77,087	(14,99,643)	4,15,35,952
	Total Noida Centre	54,67,81,935	99,23,06,911	1,42,48,828	-	2,03,70,684	20,90,07,290	27,78,03,626	64,05,425	2,37,69,864	53,73,56,889	75,50,801	1,00,84,29,984
10	**Patna Centre**												
	MeitY Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Other Agency Projects	-	-	39,09,780	-	-	-	-	-	-	-	-	39,09,780
	Total Patna Centre	-	-	39,09,780	-	-	-	-	-	-	-	-	39,09,780
10	**Pune Centre**												
	MeitY Projects	2,04,34,49,566	2,07,52,47,000	12,55,82,244	-	22,05,08,507	36,26,13,199	11,13,97,972	34,79,455	7,16,68,316	76,96,67,449	11,77,60,818	3,35,68,50,543
	Other Agency Projects	4,10,88,15,869	77,84,82,544	20,26,01,037	-	72,82,29,628	6,86,08,068	1,08,60,62,286	8,02,325	5,20,65,145	1,93,57,67,452	(21,23,86,246)	3,36,65,18,245
	Total Pune Centre	6,15,22,65,435	2,85,37,29,544	32,81,83,281	-	94,87,38,135	43,12,21,267	1,19,74,60,258	42,81,780	12,37,33,461	2,70,54,34,901	(9,46,25,428)	6,72,33,68,788
11	**Thiruvananthapuram Centre**												
	MeitY Projects	46,07,38,921	90,45,55,000	71,85,630	14,41,64,000	11,95,03,643	18,14,50,317	24,64,72,666	22,53,454	20,42,97,321	75,39,77,401	15,35,34,958	60,91,31,192
	Other Agency Projects	3,73,54,647	2,42,27,551	15,45,250	-	35,33,970	1,87,57,217	90,30,793	5,630	1,47,48,647	4,60,76,257	55,925	1,69,95,266
	Total Thiruvananthapuram Centre	49,80,93,568	92,87,82,551	87,30,880	14,41,64,000	12,30,37,613	20,02,07,534	25,55,03,459	22,59,084	21,90,45,968	80,00,53,658	15,35,90,883	62,61,26,458
	Total MeitY Projects	**3,47,38,71,566**	**4,57,13,36,649**	**16,17,00,139**	**15,53,22,108**	**40,44,56,295**	**92,76,74,608**	**67,69,95,000**	**1,77,20,900**	**35,42,45,997**	**2,38,10,92,800**	**52,04,97,604**	**5,46,06,40,057**
	Total Other Agency Projects	**4,65,76,53,988**	**1,12,30,26,577**	**21,45,96,143**	**5,19,416**	**78,38,77,213**	**25,57,13,290**	**1,21,11,20,857**	**23,10,184**	**10,63,32,433**	**2,35,93,53,977**	**(20,43,96,942)**	**3,84,08,39,090**
	Grand Total	**8,13,15,25,554**	**5,69,43,63,226**	**37,62,96,282**	**15,58,41,524**	**1,18,83,33,508**	**1,18,33,87,898**	**1,88,81,15,857**	**2,00,31,084**	**46,05,78,430**	**4,74,04,46,777**	**31,61,00,662**	**9,30,14,79,147**

Amount in ₹

Particulars	2020-21	2019-20

Schedule 4 - Current Liabilities and Provisions

A. Current Liabilities		
1. Trade Payables (For Goods and Others)	1,15,43,97,264	73,24,61,165
2. Advances Received		
a) Advances Received from Parties	2,35,01,81,230	2,15,53,68,532
b) Fees Received in Advance	12,000	12,000
c) AMC Charges Received in Advance	-	-
d) Other Income Received in Advance	18,66,51,965	19,07,05,335
3. Statutory Liabilities		
a) Members CPF Recovery Payable	1,92,72,673	1,12,84,271
b) Members VPF Payable	26,69,341	10,82,284
c) Members CPF Loan Recovery Payable	61,165	3,311
d) Members Benevolent Fund Payable	8,31,124	5,18,914
e) Members CGEIS/Group Insurance Payable	65,508	1,42,176
f) Members Other Recoveries Payable	8,23,511	6,23,961
g) C-DAC's Contribution to CPF Payable	2,28,70,005	1,57,47,392
h) Gratuity Payable	11,41,87,059	16,47,12,982
i) Leave Salary and Pension Contribution Payable	33,98,04,125	37,52,43,029
j) Members Income Tax Payable	3,27,74,461	2,31,69,737
k) Tax Deducted at Source Payable	1,69,94,670	93,44,064
l) Profession Tax Payable	3,14,828	3,37,322
m) Service Tax Payable	-	-
n) CGST Payable	60,63,888	(36,72,657)
o) SGST Payable	80,36,975	(36,72,658)
p) IGST Payable	11,02,20,672	2,50,95,691
q) UTGST Payable	-	-
r) Reverse charge GST Payable	(2,65,293)	1,13,374
4. Other Current Liabilities		
a) Unpaid Salaries	1,42,06,419	1,15,77,169
b) Library Deposits Payable	85,950	90,450
c) Other Security Deposits Payable	4,05,76,283	7,72,17,101
d) Earnest Money Deposit Contractors Payable	3,83,85,816	4,17,32,630
e) Retention Deposit Contractors	99,19,607	1,50,53,528
f) Refund of Course Fees Due	16,15,512	1,36,51,421
g) ATC's & Others Share in Fees Payable	94,726	12,14,726
h) Other Current Liabilities	8,42,90,034	54,82,74,032
Total (A)	4,55,51,41,518	4,40,74,31,282
B. Provisions		
1. Others (Specify)		
a) Provisions / Accrued Liabilities for Expenses	32,45,75,078	21,35,51,674
Total (B)	32,45,75,078	21,35,51,674
Total (A)+(B)	**4,87,97,16,596**	**4,62,09,82,956**

Schedule-5 FIXED ASSETS Acquired out of own funds
(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

Sr. No.	Particulars	Gross Block						Depreciation					Net Block	
		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	3,21,67,475	-	-	-	-	3,21,67,475	-	-	0%	-	-	3,21,67,475	3,21,67,475
	b) Leasehold	17,21,96,623	-	-	-	-	17,21,96,623	2,09,20,091	-	0%	6,97,292	2,16,17,383	15,05,79,240	15,12,76,532
2	Building													
	a) On Freehold Land	91,18,277	-	-	-	-	91,18,277	57,60,522	-	10%	3,35,776	60,96,298	30,21,979	33,57,755
	b) On Leasehold Land	10,89,53,874	-	-	-	-	10,89,53,874	8,80,60,013	-	10%	20,89,386	9,01,49,399	1,88,04,475	2,08,93,861
	c) Ownership Flats/Premises	3,97,26,295	-	-	-	-	3,97,26,295	3,32,16,645	-	10%	6,50,965	3,38,67,610	58,58,685	65,09,650
	d) Superstructures on Land not belonging to the entity	1,47,34,869	-	-	-	13,08,028	1,34,26,841	1,34,32,608	11,64,906	10%	1,15,914	1,23,83,616	10,43,225	13,02,261
3	Plant, Machinery and Equipments	7,10,92,903	29,84,143	1,17,778	31,01,921	67,37,562	6,74,57,262	5,68,17,922	63,37,969	15%	25,46,596	5,30,26,549	1,44,30,713	1,42,74,981
4	Vehicles	2,18,14,668	-	-	-	-	2,18,14,668	1,10,73,316	-	15%	16,11,203	1,26,84,519	91,30,149	1,07,41,352
5	Furniture & Fixtures	9,95,60,690	11,36,257	6,52,242	17,88,499	16,99,347	9,96,49,842	7,39,63,777	10,21,905	10%	26,70,797	7,56,12,669	2,40,37,173	2,55,96,913
6	Office Equipments	4,74,25,223	6,93,724	10,91,967	17,85,691	10,54,029	4,81,56,885	3,03,77,736	5,91,684	15%	27,55,625	3,25,41,677	1,56,15,208	1,70,47,487
7	Air Conditioning Equipments	3,59,85,368	-	-	-	4,84,052	3,55,01,316	2,94,46,154	4,75,389	15%	9,79,584	2,99,50,349	55,50,966	65,39,213
8	Computer Peripherals	42,13,87,541	1,53,22,469	2,21,70,699	3,74,93,168	6,12,83,166	39,75,97,543	37,69,03,715	6,11,08,681	40%	3,27,21,002	34,85,16,036	4,90,81,506	4,44,83,826
9	Electrical Installations	6,57,33,165	1,01,683	38,62,427	39,64,110	6,70,309	6,90,26,966	4,80,08,008	6,25,419	10%	21,64,439	4,95,47,028	1,94,79,937	1,77,25,155
10	Electronic Tools & Lab Equipments	89,47,376	1,53,930	54,93,109	56,47,039	-	1,45,94,415	68,22,250	-	15%	11,65,825	79,88,075	66,06,340	21,25,126
11	Library Books	1,55,70,687	4,919	5,971	10,890	23,740	1,55,57,837	1,52,88,923	23,740	40%	1,17,061	1,53,82,244	1,75,593	2,81,764
12	Copyright Know-how	66,950	-	-	-	-	66,950	65,769	-	25%	295	- 66,064	886	1,181
13	Other Fixed Assets	69,78,272	-	29,43,317	29,43,317	-	99,21,589	56,09,786	-	15%	6,46,771	62,56,557	36,65,032	13,68,486
	Total	**1,17,14,60,256**	**2,03,97,125**	**3,63,37,510**	**5,67,34,635**	**7,32,60,233**	**1,15,49,34,658**	**81,57,67,235**	**7,13,49,693**		**5,12,68,531**	**79,56,86,073**	**35,92,48,582**	**35,56,93,018**
	Capital Work-in-progress	**-**	**52,500**	**53,96,277**	**54,48,777**	**-**	**54,48,777**	**-**	**-**		**-**	**-**	**54,48,777**	**-**
	Grand Total	**1,17,14,60,256**	**2,04,49,625**	**4,17,33,787**	**6,21,83,412**	**7,32,60,233**	**1,16,03,83,435**	**81,57,67,235**	**7,13,49,693**		**5,12,68,531**	**79,56,86,073**	**36,46,97,358**	**35,56,93,018**
	Previous Year	**1,11,97,20,875**	**2,33,30,427**	**3,34,81,491**	**5,68,11,918**	**50,72,537**	**1,17,14,60,256**	**77,17,87,317**	**41,31,194**		**4,81,11,112**	**81,57,67,235**	**35,56,93,018**	**34,79,33,556**

Schedule-6 FIXED ASSETS Acquired out of Grant-In-Aid
(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

Sr. No.	Particulars	Gross Block						Depreciation					Net Block	
		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	28,66,502	-	0%	1,71,770	30,38,272	1,37,07,439	1,38,79,209
2	Building													
	a) On Freehold Land	21,87,89,031	-	-	-	-	21,87,89,031	12,15,22,542	-	10%	97,26,649	13,12,49,191	8,75,39,840	9,72,66,489
	b) On Leasehold Land	13,27,01,184	-	-	-	-	13,27,01,184	10,68,73,346	-	10%	25,82,784	10,94,56,130	2,32,45,054	2,58,27,838
	c) Ownership Flats/Premises	33,41,269	-	-	-	-	33,41,269	30,10,235	-	10%	33,103	30,43,338	2,97,931	3,31,034
	d) Superstructures on Land not belonging to the entity	-	24,29,659	29,59,601	53,89,260	-	53,89,260	-	-	10%	5,38,926	5,38,926	48,50,334	-
3	Plant, Machinery and Equipments	9,10,19,283	-	-	-	-	9,10,19,283	7,91,00,702	-	15%	17,87,787	8,08,88,489	1,01,30,794	1,19,18,581
4	Vehicles	1,00,13,336	-	-	-	-	1,00,13,336	91,45,717	-	15%	1,30,142	92,75,859	7,37,477	8,67,619
5	Furniture & Fixtures	13,76,91,085	13,81,952	6,90,680	20,72,632	5,12,237	13,92,51,480	9,35,28,274	4,52,031	10%	46,17,522	9,76,93,765	4,15,57,715	4,41,62,811
6	Office Equipments	5,26,51,763	9,900	44,199	54,099	1,82,867	5,25,22,995	4,48,42,232	1,42,406	15%	11,73,476	4,58,73,302	66,49,693	78,09,531
7	Air Conditioning Equipments	5,32,25,946	6,44,361	12,03,314	18,47,675	15,200	5,50,58,421	4,41,20,520	12,208	15%	16,42,518	4,57,50,830	93,07,591	91,05,426
8	Computer Peripherals	1,09,08,61,740	35,11,877	24,86,355	59,98,232	11,13,914	1,09,57,46,058	1,08,10,78,112	11,13,312	40%	60,44,138	1,08,60,08,938	97,37,120	97,83,628
9	Electrical Installations	6,82,97,746	-	-	-	10,403	6,82,87,343	5,04,38,091	7,642	10%	17,85,689	5,22,16,138	1,60,71,205	1,78,59,655
10	Electronic Tools & Lab Equipments	10,19,45,901	-	-	-	2,75,666	10,16,70,235	8,92,14,794	2,51,233	15%	19,06,001	9,08,69,562	1,08,00,673	1,27,31,107
11	Library Books	3,99,49,205	17,212	4,949	22,161	-	3,99,71,366	3,99,07,756	-	40%	25,443	3,99,33,199	38,167	41,449
12	Copyright Know-how	4,40,660	-	-	-	-	4,40,660	4,40,646	-	25%	4	4,40,650	10	14
13	Other Fixed Assets	71,79,941	-	17,582	17,582	-	71,97,523	63,08,402	-	15%	1,33,368	64,41,770	7,55,753	8,71,539
	Total	**2,02,97,58,651**	**79,94,961**	**74,06,680**	**1,54,01,641**	**21,10,287**	**2,04,30,50,005**	**1,77,23,97,871**	**19,78,832**		**3,22,99,320**	**1,80,27,18,359**	**24,03,31,646**	**25,73,60,780**
	Capital Work-in-progress	1,65,76,70,462	46,03,944	-	46,03,944	46,03,944	**1,65,76,70,462**	-	-		-	-	1,65,76,70,462	1,65,76,70,462
	Grand Total	**3,68,74,29,113**	**1,25,98,905**	**74,06,680**	**2,00,05,585**	**67,14,231**	**3,70,07,20,467**	**1,77,23,97,871**	**19,78,832**		**3,22,99,320**	**1,80,27,18,359**	**1,89,80,02,108**	**1,91,50,31,242**
	Previous Year	3,70,39,27,227	1,52,62,037	1,20,55,590	2,73,17,627	4,38,15,741	3,68,74,29,113	1,78,14,68,213	4,35,92,053		3,45,21,711	1,77,23,97,871	1,91,50,31,242	1,92,24,59,014

Schedule-7 FIXED ASSETS Acquired out of Project Grants
(Attached to and forming an integral part of Balance Sheet)

Amount in ₹

Sr. No.	Particulars	Gross Block						Depreciation					Net Block	
		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	35,06,65,464	61,50,751	36,66,863	98,17,614	-	36,04,83,078	31,54,12,371	-		1,33,79,490	32,87,91,861	3,16,91,217	3,52,53,093
2	Chennai Centre Project Assets	9,36,29,638	34,20,027	-	34,20,027	-	9,70,49,665	8,41,84,313	-		32,49,631	8,74,33,944	96,15,721	94,45,325
3	Corporate Project Assets	-	-	-	-	-	-	-	-		-	-	-	-
4	Delhi Centre Project Assets	15,72,623	-	-	-	-	15,72,623	15,67,699	-		-	15,67,699	4,924	4,924
5	Hyderabad Centre Project Assets	30,83,33,175	2,37,07,128	2,83,39,559	5,20,46,687	-	36,03,79,862	24,46,59,840	-		4,21,04,529	28,67,64,369	7,36,15,493	6,36,73,335
6	Kolkata Centre Project Assets	2,77,37,906	30,61,804	42,91,797	73,53,601	-	3,50,91,507	2,43,32,117	-		43,03,756	2,86,35,873	64,55,634	34,05,789
7	Mohali Centre Project Assets	10,65,53,082	18,12,023	87,61,934	1,05,73,957	-	11,71,27,039	9,33,62,644	-		74,50,116	10,08,12,760	1,63,14,279	1,31,90,438
8	Mumbai Centre Project Assets	31,63,64,554	-	1,29,75,190	1,29,75,190	-	32,93,39,744	29,17,01,475	-		1,13,99,350	30,31,00,825	2,62,38,919	2,46,63,079
9	Noida Centre Project Assets	10,24,71,195	-	2,03,70,684	2,03,70,684	-	12,28,41,879	8,37,33,711	-		1,20,39,768	9,57,73,479	2,70,68,399	1,87,37,483
11	Pune Centre Project Assets	70,74,03,109	3,53,58,002	91,33,80,132	94,87,38,134	4,09,992	1,65,57,31,251	60,81,11,384	-		41,84,90,809	1,02,66,02,193	62,91,29,059	9,92,91,726
12	Thiruvananthapuram Centre Project Assets	80,22,44,064	7,18,57,797	5,11,79,817	12,30,37,614	-	92,52,81,678	43,02,74,077	19		8,44,00,474	51,46,74,532	41,06,07,146	37,19,69,987
	Total	**2,81,69,74,810**	**14,53,67,532**	**1,04,29,65,976**	**1,18,83,33,508**	**4,09,992**	**4,00,48,98,326**	**2,17,73,39,631**	**19**		**59,68,17,923**	**2,77,41,57,535**	**1,23,07,40,791**	**63,96,35,179**
	Capital Work-in-progress	**46,03,944**	**-**	**-**	**-**	**46,03,944**	**-**	**-**	**-**		**-**	**-**	**-**	**46,03,944**
	Grand Total	**2,82,15,78,754**	**14,53,67,532**	**1,04,29,65,976**	**1,18,83,33,508**	**50,13,936**	**4,00,48,98,326**	**2,17,73,39,631**	**19**		**59,68,17,923**	**2,77,41,57,535**	**1,23,07,40,791**	**64,42,39,123**
	Previous Year	**2,77,12,39,119**	**6,79,35,708**	**16,56,62,608**	**23,35,98,315**	**18,32,58,681**	**2,82,15,78,754**	**1,96,67,82,089**	**85,340**		**21,06,42,882**	**2,17,73,39,631**	**64,42,39,123**	**80,44,57,030**

Amount in ₹

Particulars	2020-21	2019-20

Schedule 8 - Current Assets, Loans and Advances

A. Current Assets		
1. Inventories :		
a) Stock in trade		
Finished Goods	58,07,05,260	70,18,72,582
Work-in-progress	72,834	1,05,008
Raw Material	12,45,762	13,30,862
b) Stock of Course Material	16,53,863	15,19,242
2. Sundry Debtors		
Trade Receivables	1,46,02,65,657	1,23,31,79,970
Less: Provision for Bad and Doubtful Debts	29,60,98,157	26,94,62,254
	1,16,41,67,500	96,37,17,716
3. Cash balances in hand (including cheques/drafts and imprest)	2,577	69,638
4. Bank Balances		
a) With Scheduled Banks		
On Deposit Accounts (includes margin money)	13,14,63,26,031	11,71,60,77,779
On Savings/Current Account	2,08,74,75,566	1,54,56,82,528
b) Funds/Goods in Transit	17,33,442	75,058
5. Post Office-Savings Accounts	10,234	3,171
Total (A)	16,98,33,93,069	14,93,04,53,584
B. Loans, Advances and Other Assets		
1. Loans		
a) Staff	41,75,543	63,11,218
b) Other (Specify)	12,06,997	9,06,937
2. Advances and other amounts recoverable in cash or in kind or for value to be received		
a) On Capital Account	3,60,13,256	3,60,13,256
b) Prepayments (Advances to Suppliers)	14,70,82,140	7,43,12,342
c) To Employees	23,30,322	1,23,31,371
d) To Others	18,08,71,832	19,50,63,438
3. Income Accrued		
a) On Investments from Earmarked/Endowment Funds	-	-
b) On Bank Deposits	21,48,86,182	25,96,14,120
c) Others		
I) Course Fee Receivable	14,93,775	8,87,575
ii) Receivable from Guest House Receipts	-	-
iii) Other Grants Receivables	8,05,68,000	68,08,000
4. Claims Receivable		
a) Insurance Claims Lodged but not received	-	-
b) Cliams due but not received	6,25,354	6,25,354
c) Income Tax Deducted at Source	20,00,26,912	20,32,73,991
d) Sales Tax / VAT Refund Due	49,668	2,61,290
e) CGST Receivable	81,27,779	1,50,03,997
f) SGST Receivable	81,27,780	1,50,03,997
g) IGST Receivable	1,23,05,958	2,93,76,595
h) UTGST Receivable	-	-
i) Reverse Charge GST Receivable	8,710	6,502
j) Input Tax Credit GST Receivable	1,12,59,780	1,97,38,546
k) GST Paid on Advance Receipt	8,06,11,558	4,91,03,112
l) Receivable from PF Trust	-	-
m) Other Receivables	72,61,798	74,70,658
5. Prepaid Expenses		
a) Insurance	9,31,037	14,82,325
b) Other Expenses	1,51,42,009	98,25,032

Amount in ₹

Particulars	2020-21	2019-20
6. Deposits (Assets)		
a) Telephone Deposit	12,47,215	12,30,637
b) Lease Rent Deposit	4,00,98,792	4,02,78,792
c) Other Deposits	2,67,12,268	2,65,47,230
d) Security Deposit	1,33,38,043	1,40,85,937
e) EMD / Tender Deposit	2,01,68,615	1,98,27,815
7. Differed Expenses		
a) Unutilised Modvat / Cenvat	-	-
Total (B)	1,11,46,71,323	1,04,53,90,067
Total (A+B)	**18,09,80,64,392**	**15,97,58,43,651**

Schedule 9 - Income from Sales/Services

1. Income from Sales		
a) Sale of Finished Goods	56,72,86,539	77,54,86,141
b) Sale of Raw Material	-	-
c) Sale of Scraps	3,94,459	2,63,851
2. Income from Services		
a) Software Development Charges	63,14,50,769	81,82,29,087
b) Others (Specify)	-	-
AMC Charges Received	3,70,56,967	2,51,57,652
Consultancy Charges / Service Charges	1,80,23,58,174	1,47,26,04,207
TOT Fees Received	90,00,000	20,20,000
Royalty Received	9,60,000	13,55,100
Data Charges	9,52,50,862	6,82,23,355
3. Inter Unit / Inter Branch Sales / (Purchases)	26,46,810	8,75,000
Total	**3,14,64,04,580**	**3,16,42,14,393**

Schedule 10 - Grants/Subsdies
(Irrevocable Grants & Subsdies Received)

1. Central Government	1,25,00,00,000	1,20,00,00,000
2. Others (Specify)		
a) C-DAC's own Contribution and Other Adjustments	9,97,22,324	36,930
3. Less : Amount utilised for Capital Expenditure in the current year transferred to Capital Reserve	1,52,70,186	73,18,974
Total	**1,33,44,52,138**	**1,19,27,17,956**

Schedule 11 - Fees/Subscriptions
(Accounting Policies towards each item are to be disclosed)

1. Entrance Fees	-	-
2. Course Fees	18,67,80,191	83,84,98,891
3. Corporate Training Fees	31,36,016	90,89,213
4. Annual Fees/Subscriptions	96,19,020	1,08,57,624
5. Authorization Fees	-	-
6. Others (Specify)	-	-
a) Virtual Centre Processing Fees	-	-
b) Admission Cancellation Fees	6,96,865	24,47,966
c) Examination Fees	33,36,506	3,26,25,287
d) Late Fee	1,958	14,989
e) Registration Fees / Project Fee	4,31,995	11,98,591
f) Students Hostel Fees	8,33,839	1,97,74,446
TOTAL	**20,48,36,390**	**91,45,07,007**

Amount in ₹

Particulars	2020-21	2019-20
Schedule 12 - Interest Received		
1. On Term Deposits		
a) With Scheduled Banks	26,48,81,112	23,55,47,872
2. On Savings Accounts		
a) With Scheduled Banks	2,48,62,340	1,61,18,127
3. On Loans		
a) Employees/Staff	2,04,662	2,66,429
Total	**28,99,48,114**	**25,19,32,428**
Schedule 13 - Other Income		
1. Profit on Sale/Disposal of Assets		
a) Owned Assets	1,57,279	1,05,674
b) Assets acquired out of grants, or received free of cost	(90,669)	-
2. Exports Incentives Realized	-	-
3. Fees for Miscellaneous Services	14,77,298	8,30,779
4. Miscellaneous Income	1,38,28,043	42,56,166
Total	**1,53,71,951**	**51,92,619**
Schedule 14 - Increase/(Decrease) In Stock of Finished Goods & Work-In-Progress		
a) Closing Stock		
Finished Goods	58,07,05,260	70,18,72,582
Work-in-progress	72,834	1,05,008
Raw Material	12,45,763	13,30,862
Loose Tools	-	-
Course Material Stock	16,53,863	15,19,242
b) Less : Opening Stock		
Finished Goods	70,18,72,582	21,94,90,775
Work-in-progress	1,05,008	1,42,124
Raw Material	13,30,862	20,95,756
Loose Tools	-	-
Course Material Stock	15,19,242	27,49,050
Total (a-b)	**(12,11,49,974)**	**48,03,49,989**
Schedule 15 - Establishment Expenses		
a) Salaries & Wages	2,17,93,74,443	1,98,16,94,849
b) Allowances & Bonus		
Awards & Prizes	2,69,452	4,52,337
Bonus	48,962	-
Canteen Facility	1,88,62,013	2,35,32,692
Hire Charges - Contractual Services	11,93,41,845	13,04,22,962
Lease Rent for Employees Quarters	-	-
Leave Travel Concession	3,14,18,591	57,50,295
Medical Reimbursement	9,12,06,919	9,30,51,104
Members Medical & Accident Insurance Expenses	5,76,953	5,82,082
Misc. Allowances and Other Reimbursements	2,42,71,650	2,12,56,940
Staff Recruitment Expenses	31,02,959	46,80,510
Staff Training Expenses	12,97,739	22,27,903
Transfer & Relocation Expenses	8,05,074	63,020
c) Contribution to Provident Fund	17,98,78,276	18,98,89,896
d) Staff Welfare Expenses	45,48,197	39,99,806
e) Expenses on Employees Retirement and Terminal Benefits	-	-
Gratuity	10,88,71,193	19,94,47,816
Leave Encashment	6,76,14,563	13,27,15,100
Leave Salary & Pension Contribution	58,34,366	10,10,62,197
f) Others	2,46,467	92,924
Total	**2,83,75,69,662**	**2,89,09,22,433**

Amount in ₹

Particulars	2020-21	2019-20
Schedule 16 - Other Administrative Expenses		
a) Purchases	39,77,76,833	1,13,12,32,739
b) Direct Expenses		
Consumables	1,59,54,657	2,19,73,171
Design and Development Charges	-	9,68,010
Excise/Custom Duty/Service Tax Paid	12,68,506	22,13,853
Freight and Handling Expenses	37,593	15,95,657
Labour Charges	5,65,335	-
Liquidated Damages	28,80,400	-
Material Insurance Expenses	-	1,38,192
Other Packing Charges	32,370	32,500
Royalty and Support Fees	8,32,023	-
Software Development Consultancy Charges	1,98,71,746	1,01,90,800
Technical Service Charges	44,24,02,482	37,55,94,534
Warehouse Charges	-	-
c) Expenses on Courses		
Advertisement Expenses	70,73,102	1,22,65,651
ATC's Share in Fees	4,71,27,456	23,70,79,319
Awards & Prizes	-	-
Campus Interview Expenses	6,38,713	68,53,858
Course Material Production Expenses	32,71,908	3,18,80,157
Data Entry & Scanning Expenses	-	-
Examination Expenses	7,12,563	67,97,165
Faculty Members Expenses	1,68,19,104	3,53,66,904
Other Course Related Expenses	1,41,68,047	7,56,82,879
Printing of Forms & Prospectus	1,481	67,053
Students Hostel Expenses	81,631	40,61,964
d) Administrative Expenses		
Administrative Charges on Provident Fund	70,61,248	69,85,876
Asset Hire Charges	7,63,107	28,94,895
Auditors Remuneration	15,79,615	13,11,649
Bank Charges and Commission	12,33,321	21,38,104
C-DAC's Contribution to Funded Projects	2,34,59,064	2,29,92,721
Cultural Program Expenses	6,08,124	24,51,642
Development Contracts and Spon. Project Expenses	66,22,856	13,19,848
Electricity, Power and Water Charges	6,34,01,965	8,57,93,658
Entertainment/Hospitality Expenses	13,83,409	31,00,180
Foreign Exchange Fluctuation	1,81,556	(2,83,789)
Gifts and Presentation	32,951	3,39,094
Insurance	22,85,850	17,67,988
Interest Paid	4,06,655	13,04,927
Irrecoverable Balances Written-off/(Written-back)	32,56,242	2,35,273
Legal & Professional Charges	1,68,89,443	1,43,49,163
Miscellaneous Expenses	24,72,490	23,57,997
Office Expenses	80,30,658	1,20,91,795
Postage, Telephone & Communication Charges	1,86,97,538	1,32,97,381
Printing and Stationery	34,04,282	72,46,284
Provision for Bad and Doubtful Debts/Advances	2,86,72,384	1,76,98,675
Rent, Rates and Taxes	3,92,97,252	3,85,24,215
CGST Paid	10,242	2,14,580
SGST Paid	10,242	10,445
IGST Paid	-	7,855
UTGST Paid	-	-
Reverse Charge GST Paid	-	-
Service Hire Charges	9,05,84,451	9,80,28,108
Subscription of Periodicals & Newspapers	18,51,455	19,05,945
Tender Expenses	40,540	1,02,070
Training Expenses	20,81,069	19,58,762
Transit Quarter & Guest House Expenses	8,94,001	24,41,008
Transportation Charges	45,710	2,82,042
Vehicles Hire, Running and Maintenance	59,36,339	91,24,018

Amount in ₹

Particulars	2020-21	2019-20
e) Repairs and Maintenance		
Air Conditioning Equipments	51,31,005	40,90,792
Building	92,02,128	94,90,032
Computers	81,49,046	50,93,673
Electrical Fittings	1,43,07,374	1,69,65,620
Furniture and Fixtures	10,81,476	23,96,506
Garden Maintenance	9,13,913	10,81,710
Lab Equipments	1,46,888	2,23,739
Office Equipments	9,80,156	22,66,106
Other Assets	38,06,012	31,17,245
f) Travelling and Conveyance Expenses		
Inland Travel Expenses		
Director	6,40,677	49,17,871
Members	3,20,08,428	11,42,34,405
Others	6,78,280	30,78,685
Foreign Travel Expenses		
Director	-	4,28,195
Members	-	18,04,690
Others	-	-
Conveyance Expenses	12,55,280	78,818
g) Selling Distribution and Business Promotion Expenses		
Advertisement Expenses	15,42,119	25,06,777
Expenses on Exhibition, Seminars/Workshops	5,22,720	93,23,609
Distribution Expenses	-	5,94,789
Product Literature & Brochures Expenses	-	-
Other Sales Promotion Expenses	7,91,026	2,11,515
h) Corporate Office Expenses	-	-
i) Other Expenses	-	-
Total Other Administrative Expenses	**1,38,38,66,537**	**2,48,78,91,592**

Schedule 17: 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 Goods and Services Tax.

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 depreciated at full rates irrespective of the date of acquisition. Depreciation is charged at the rates prescribed by the 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 whichever 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.

Indira Pasupathy Director Finance	**Sunil Misar** Registrar (I/C)	**Col. A.K. Nath** Director General (I/C)

For **M/s Lahoti Kasat & Co.(FRN:105509W)**
Chartered Accountants

CA Rohit Kasat
Partner (MRN.151410)
UDIN : 21151410AAAADV4397

Date : 30th October, 2021
Place : Pune

Schedule 18: 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.

The process for transfer of title deeds of Immovable properties in the name of C-DAC of the above centres is under process. No liability towards expenses such as stamp duty, taxes and other expenses (if any) is provided for. The same will be accounted for in the year of payment if any.

2. **Capital Commitment**

Capital Commitments not provided for ₹16,320.54 Lakhs (Previous year ₹26,448.85 Lakhs).

3. **Sponsored Projects**

Balance of Core Grant Projects as per Annexure 1 of Schedule 3 to the Balance Sheet includes unutilized grants amounting to ₹0.00 Lakhs (Previous year ₹0.00 Lakhs) and ₹1,757.89 Lakhs (Previous year ₹2,188.63 Lakhs) grants receivable on account of expenditure incurred in anticipation of release of grants on projects.

Balance of unutilized Funded Projects grants as per Annexure 2 of Schedule 3 to the Balance Sheet includes unutilized grants amounting to ₹94,305.61 Lakhs (Previous year ₹83,102.02 Lakhs) and ₹1,290.82 Lakhs (Previous year ₹1,786.77 Lakhs) grants receivable on account of expenditure incurred in anticipation of release of grants on projects.

4. **Contingent Liabilities**

4.1. Against Bank Guarantees: ₹1,461.58 Lakhs. (Previous year ₹989.78 Lakhs)
4.2. Against Letter of Credit ₹0.00 Lakhs. (Previous year ₹33.00 Lakhs)
4.3. Against Liquidated Damages: ₹ Nil Lakhs (Previous year ₹ Nil Lakhs)
4.4. Against Sales Tax: ₹18.06 Lakhs (Previous year ₹11.21 Lakhs)
4.5. Against Service Tax: ₹60.02 Lakhs (Previous year ₹60.01 Lakhs)
4.6. Cases related to staff at various centres are pending at various levels for which liability cannot be assessed.
4.7. Goods and Services Tax Assessments are pending for assessment and therefore liability cannot be assessed.

5. **Statutory Liabilities**

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

6. **Foreign Currency Transactions**

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

(₹ in Lakhs)

Centre	Raw Material / Components	Capital Goods	Total
Current Year	712.29	324.57	1,036.86
Previous Year	797.94	330.59	1,128.10

6.2 **Expenditure in foreign currency for Travel:** ₹0.00 Lakhs. (Previous Year ₹ 42.88 Lakhs.)
6.3 **Other Expenditure in foreign currency**: ₹19.22 Lakhs (Previous Year ₹303.65 Lakhs.)

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

Currency	Current Year	Previous Year
US Dollars	0.00	540.00
Euro	0.00	13,000.00
Total Value in ₹ (In Lakhs)	0.00	10.38

7. Remuneration to Statutory Auditors (Including Branch Auditors)

(₹ in Lakhs)

Particulars	Current Year	Previous Year
Audit Fees (Exclusive of GST)	2.98	3.19

8. Interest received on grants is treated as liability. Expenses on the core/sponsored projects are charged to respective project and not routed through Income & Expenditure Account.

9. Fixed Assets: The depreciation on the assets purchased out of grants is debited to Capital Reserve.

10. Current Assets and Current Liabilities

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

10.2 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.

10.3 Out of debtors outstanding for more than three years for ₹3,303.23 Lakhs (Previous year ₹2,919.20 Lakhs) a provision of ₹2,960.98 Lakhs (Previous year ₹2,694.62 Lakhs) has been made up to 31st March, 2021. Provision for ₹342.25 Lakhs (Previous year ₹224.58 Lakhs) has not been made {Noida ₹314.44 Lakhs (Previous year ₹163.37 Lakhs) and Mohali ₹27.81 Lakhs (Previous year ₹61.21 Lakhs)} as they are for ongoing projects / parties and the management of the C-DAC is of the opinion that the same will be realized shortly.

Age wise Analysis of Sundry Debtors is as follows:

(₹ In Lakhs)

Centre Name	Less than 6 months	More Than 6 months	More Than 1 year	More Than 2 years	More Than 3 years	Total
Bengaluru	12.74	1.16	6.59	0.00	171.16	191.65
Chennai	57.19	11.86	3.24	0.00	0.00	72.29
Delhi	911.40	72.53	27.66	0.00	136.48	1148.07
Hyderabad	130.14	6.49	18.20	3.99	7.58	166.40
Kolkata	440.32	0.00	10.89	36.87	35.62	523.70
Mohali	126.57	50.91	164.92	5.19	27.81	375.40
Mumbai	129.45	90.46	54.09	221.10	629.78	1124.88
Noida	1976.29	843.83	648.99	423.74	1025.08	4917.93
Patna	0.00	0.00	0.00	0.00	0.00	0.00
Pune	3492.15	14.17	128.43	204.82	1188.52	5028.09
Thiruvananthapuram	471.35	88.30	222.58	190.81	81.20	1054.24
Total	**7747.60**	**1179.71**	**1285.59**	**1086.52**	**3303.23**	**14602.65**
Previous Year	**6241.59**	**609.87**	**1448.51**	**1112.63**	**2919.20**	**12331.80**

11. Accounting of grants is made on accrual basis. The Core Grants & expenditure related to Core Grants (net off capital expenditure) is routed through Income & Expenditure account.

12. Physical Verification
Due to COVID-19 coronavirus pandemic has resulted delay in conducting the physical verification & related reports for FY 2020-21. Reconciliation is in progress and the same will be completed in FY 2021-22.

13. Internal Audit / Internal Control Systems
C-DAC has an internal control system, which is commensurate with the size and financial transactions. Internal audit is being conducted by external auditors during the year.

14. Employee Benefits
Employees benefits with respect to Gratuity and Leave encashment has been paid/provided as per provisions of Accounting Standard I5 Employee Benefits based on the actuarial valuation /demand as per policy except as given in notes to accounts of centres.

15. Lease Obligations
Lease rent of ₹205.30 Lakhs (Previous year ₹239.25 Lakhs) for various premises are debited under the various heads of Income and Expenditure Account for the period under audit as per the Accounting Standard 19 Leases.

16. Impairment of Assets
As per Accounting Standard 28 Impairment of Assets, fixed assets are reviewed for impairment and there is no impairment of assets during the year, as the carrying amount of the assets are less than the realizable value.

17. Other Discloser Requirements
The Management of C-DAC is of the opinion that C-DAC being a scientific society and not a listed company and therefore the reporting requirements as per Accounting Standard 3 on Cash flow statement, Accounting Standard 17 on Segment Reporting, Accounting Standard 18 on Related Party Disclosures and Accounting Standard 26 in respect of Intangible Assets are not applicable.

18. Advances paid to employees include ₹0.00 Lakhs as advances paid to Director General (Previous Year ₹2.22 Lakhs).

19. Centre Specific Notes

19.1. **Delhi Centre**

19.1.1. No liability has been provided for in respect of civil suit of recovery for ₹322.98 Lakhs filed by M/s IBILT Technology Ltd in DIPP's IPO Project with an outlay of ₹2,340/- Lakhs, since the case is under examination with Hon'ble High Court, Delhi.

19.1.2. An order of ₹2,683/- Lakhs was given to NBCC for construction of Office Building in Jasola out of which an amount of ₹2,506/- Lakhs has been paid to NBCC including an advance of ₹360/- Lakhs. The advance will be adjusted against final RA bill to be submitted by NBCC. No liability has been created for ₹537/- Lakhs.

19.2. **Mumbai Centre**

19.2.1. The Law Secretary cum Appellate Authority has given an award for increase in the rent from 01-04-1995 till the date of vacation of premises(01-11-2013) of Air India located at Nariman point, Mumbai, for an amount along with interest at the rate of 6% till 30-06-2017 is ₹2,607/- Lakhs and the Interest at the rate of 12% p.a. from July 2017 onwards for which no provision has been made in the books of accounts as the case is referred to MeitY for settling this dispute through Administrative Mechanism for Resolution of Central Public Sector Enterprises Dispute (AMRCD).

19.2.2. As per the actuarial valuation, total outstanding liability in respect of Pension Fund is ₹3,983/- Lakhs, against which ₹3,247/- Lakhs has been provided in the books of accounts (Fund Value ₹815/- Lakhs plus cumulative provision ₹2,432/- Lakhs) as on 31st March 2021. Provision for ₹736/- Lakhs has not been made due to short receipt of Grant in Aid.

19.2.3. Conveyance Deed for the office and residential buildings in Mumbai has 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 1st April, 1986 and 1st June, 1986, respectively.

19.2.4. The Centre has undertaken Software Development Project of ECGC ERP Revamp (2nd Phase) from ECGC Limited at a total project cost of ₹11,000/- Lakhs (excl. GST) for a period of 3 years w.e.f., March-2019. An amount of ₹1,650/- Lakhs (15% of project cost) has been received on “on approval of proposal” and accounted as Business Income up to FY 2020-21. Nationwide Covid-19 pandemic has impacted on project activities and due to ongoing lockdown, the 2nd milestone phase of ECGC Project has also been delayed. Considering all facts, the project may be extended for further period of 1 or 2 years as initially decided to complete in 3 years. Hence, the accrual income provision of above project is not made.

19.2.5. The Centre has Bulk SMS activity under MEGD Project. Under this activity, the centre purchases a certain number of Bulk SMS from service providers (Airtel, Vodafone, etc.) and credits the same to various Govt. & Non Govt. parties as per their demands and raises invoices to the parties. Furthermore, the service providers raises the bills on the centre as per the actual SMS consumed by the parties. All the utilized SMS till 31/03/2021 have been billed by the centre. The amount equivalent to ₹682.41 Lakhs is available with the Centre as on 31/03/2021 towards unutilized SMS by the parties. The said amount is transferred to "Advance Received from Party".

19.2.6. The amount received /credited in the Centre’s bank account since April 2018 accumulating to ₹164.75 Lakhs has not been recognized and hence, not accounted in the books as on 31/3/2021. The said amount is shown under “Funds Received (Untraceable) MEGD A/c" under Current Liabilities.

19.2.7. The Centre has been awarded a project named "Child Sex Abuse Material (CSAM) NCRB" from Home Ministry, Govt. of India, and an advance amount has been received as first installment for ₹415.67 Lakhs (Software Delivery ₹87.03 Lakhs & Hardware ₹328.64 Lakhs). The procurement of Hardware is under process as on 31/03/2021. Currently, the unutilized amount of ₹328.64 Lakhs from the first installment received is transferred to "Advance Received from Party".

19.3. **Noida Centre**

19.3.1. In one of the funded project, namely NAVIC GPS project, an advance of ₹600/- Lakhs is given to two parties (M/s Manjeera Digital Systems Pvt. Ltd., Hyderabad & M/s Accord Software & Systems Pvt. Ltd, Bangalore) which are shown as advance to others and accordingly not shown as expenditure in the project.

19.3.2. In respect of Business Development Division, Chandigarh –VAT Assessment has been completed up to AY 2010-11. (There is a demand of ₹13.07Lakhs for non-consideration input credit against this, an amount of ₹3.26Lakhs has been deposited under protest on dated 26th February, 2020 and the appeal is in process.)

19.4. **Pune Centre**

19.4.1. Under National Supercomputing Mission (NSM) Project as per the MOU between C-DAC and the respective institutes, C-DAC will Supply/ install, commission and operate HPC Facility along with data centre at host Institution from NSM Project funds. Host institution will be the sole custodian of HPC systems during and after installation and commissioning. The ownership of the assets vest with MeitY, (Govt. of India). The payment released during the year for supply/installation and commissioning of the HPC system at various institutes is accordingly booked under components and consumables (expenditure) in the NSM project.

19.4.2. "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) regarding transfer of rights to use and develop immovable properties viz. Main Building, NPSF Building and assets therein respectively are not registered.

19.4.3. Funds belonging to C-DAC Employees Benevolent Fund funds are not separately invested as on 31st March 2021.

19.4.4. No provision is made for the Advances to employees against various claims amounting to ₹11.54 Lakhs (Previous year ₹35.77 Lakhs), which will be booked in the FY 2021-22. As most of the claims will directly be debited to the Projects / Grants.

19.4.5. Under the Delhi Safe City Project, during the FY 2019-20, an amount of ₹674.28 Lakhs was debited to the stock of finished goods & work in progress and charged as expenditure in income and expenditure account. During the current year the project has been treated as a funded project. Accordingly the stock of finished goods & work in progress is reduced in schedule 14 and prior period expenditure has been credited with ₹674.28 Lakhs.

19.5. **Patna Centre**

Grant received for Patna Centre from Govt. of Bihar is shown as a project grants till FY 2019-20. During the current year these are shifted to Core Grants (Scheduled 3) as separate balance sheet has been prepared from the FY 2020-21 and an amount of ₹721.36 Lakhs (₹682.26 Lakhs as per annexure 1 of schedule 3 and ₹39.09 Lakhs as per annexure 2 of schedule 3) of Core Grant received from Govt. of Bihar is carried forward to the next year.

19.6. **Thiruvananthapuram Centre**

19.6.1. Advances includes the amount paid to M/s. Eworkz, Los Angeles, USA, ₹25.41 Lakhs for the supply and installation of a LCD based video wall system at police control room Kochi and the customs duty paid to clear the consignment. Since the Indian agent of the party has not come forward for the installation of the system, Centre has taken action to recover the advance through legal recourse.

19.6.2. Land on which the main building at Vellayambalam of the Centre is situated is on lease from Government of Kerala, but no lease deed has been registered so far and the land has not been assigned in favor of C-DAC's name. In the absence of specific demand, lease rent has not been provided in the books of account.

19.6.3. The total revised outlay of State of the art R&D infrastructure project of C-DAC, Technopark, Trivandrum, as approved by MeitY is ₹6,925/- Lakhs, of which MeitY's share is ₹4,155/- Lakhs and C-DAC's share is ₹2,770/- Lakhs. Total expenditure for the building was ₹5,412/- Lakhs, with MeitY's share ₹3,247/- Lakhs and C-DAC contribution ₹2165/- Lakhs. MeitY has released only ₹2,745/- Lakhs against its share of ₹3,247/- Lakhs and the balance of ₹502/- Lakhs non-receivable from MeitY is adjusted against the rent being received from KSUM (Kerala Start-Up Mission an agency of Kerala Govt.,). As on 31-03-2021, an amount of ₹31/- Lakhs has been adjusted and the balance amount of ₹471/- Lakhs will be adjusted against the rent receivable from KSUM in subsequent years.

20. The consolidated Balance Sheet and consolidated Income & Expenditure account are prepared based on the Audited Annual Accounts received from the centres.

21. Centre wise Financial Performance and Centre wise details of Assets and Liabilities, Income & Expenditure is attached as Annexure 18 (A) and 18 (B). The details of assets procured and expenses incurred from NE funds received for Silchar Centre is given in Annexure 1 of schedule 3.

22. Current year figures from audited financial statements of Centre's are regrouped wherever necessary in preparation of consolidated financial statements. Previous year's figures are regrouped, rearranged and reclassified wherever necessary.

23. Figures in the Financial Statements are rounded off to nearest Indian rupees.

Indira Pasupathy	**Sunil Misar**	**Col. A.K. Nath**
Director Finance	Registrar (I/C)	Director General (I/C)

For **M/s Lahoti Kasat & Co. (FRN:105509W)**
Chartered Accountants

CA Rohit Kasat
Partner (MRN.151410)
UDIN : 21151410AAAADV4397

Date : 30th October, 2021
Place : Pune

Annexure 18(A):
(Attached to and forming an integral part of Balance Sheet)

FINANCIAL PERFORMANCE OF C-DAC FOR THE FINANCIAL YEAR 2020-21

Amount in Lakhs

S.No	Particulars	Total	Bangalore	Chennai	Corporate	Delhi	Hyderabad	Kolkata	Mohali	Mumbai	Noida	Patna	Pune	TVM
A	**OPENING BALANCE**													
(i)	**Grant -in- Aid: Core Grant Projects**	**(2188.63)**												
	GIA General	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Core Grant Projects	(2188.63)	0.00	0.00	0.00	(870.71)	0.00	0.00	0.00	0.00	0.00	0.00	(815.92)	(502.00)
(ii)	**Grant for Sponsored Projects**	**81315.26**												
	MeitY	34738.69	330.95	212.74	0.00	146.57	2708.00	684.14	141.69	11.77	5460.94	0.00	20434.50	4607.39
	Other Agencies	46576.57	(3.62)	0.00	881.95	1570.83	1020.01	619.82	1022.25	(3.26)	6.88	0.00	41088.16	373.55
B	**RECEIPTS & INCOME**													
(i)	**Grant -in- Aid**	**12700.00**												
	GIA General	12500.00	1496.36	526.16	792.50	244.00	420.70	538.02	689.23	680.11	1020.97	0.00	4041.67	2050.28
	Core Grant Projects	200.00	0.00	0.00	0.00	70.00	0.00	0.00	0.00	0.00	0.00	0.00	130.00	0.00
(ii)	**Grant for Sponsored Projects**	**56943.64**												
	MeitY	45713.36	1181.18	40.00	0.00	145.64	3162.65	714.67	200.89	1357.68	9112.63	0.00	20752.47	9045.55
	Other Agencies	11230.28	454.10	0.00	(870.00)	1532.54	894.12	142.99	238.98	0.00	810.44	0.00	7784.83	242.28
(iii)	**Revenue Earnings**	**33512.42**												
	Training	8427.58	112.25	7.33	0.00	2.75	63.71	0.46	526.02	86.64	1006.86	0.00	6490.55	131.01
	Commercial	25084.84	155.41	1425.26	0.00	131.75	310.97	656.72	556.34	3087.84	5834.87	14.61	4725.79	8185.28
(iv)	**Interest, Other Income & C-DAC Contribution**	**1227.05**												
	GIA General	996.31	0.00	0.00	0.00	0.00	0.00	(0.91)	0.00	0.00	0.00	997.22	0.00	0.00
	Core Grant Projects	230.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200.00	30.74
		5321.39												
	MeitY Spon Projects	3170.23	9.06	3.77	0.00	2.54	225.15	11.10	6.44	11.18	131.67	0.00	1255.82	1513.50
	Spon. By Other Agencies	2151.16	3.00	0.00	(11.95)	5.22	19.09	0.07	44.35	0.00	10.82	39.10	2026.01	15.45
		1808.28												
	Training	1229.20	96.02	16.99	46.35	0.00	113.36	0.27	232.16	0.00	336.29	0.00	308.67	79.09
	Commercial	579.08	8.61	0.00	52.32	92.09	116.97	109.59	0.94	88.23	364.68	0.00	(479.80)	225.45
	TOTAL (A+B)	**190639.41**	**3843.32**	**2232.25**	**891.17**	**3073.22**	**9054.73**	**3476.94**	**3659.29**	**5320.19**	**24097.05**	**1050.93**	**107942.75**	**25997.57**
C	**REVENUE Expenditure**													
(i)	**Expenditure from Grant-In-Aid**	**12661.35**												
	GIA General	**12661.35**												
	Establishment Expenses	12112.72	1460.36	505.16	667.50	223.00	399.70	517.02	668.23	659.11	999.97	112.72	3885.67	2014.28
	Other Administrative Expenses	548.63	36.00	21.00	121.19	21.00	21.00	21.41	21.00	17.96	21.00	55.07	156.00	36.00
	Core Grant Projects	**0.00**												
	Establishment Expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Other Administrative Expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(ii)	**Expenditure on Sponsored Projects**	**35521.14**												
	MeitY Total Expenses	**19766.37**												
	Establishment Expenses	9276.74	337.90	155.50	0.00	122.85	480.83	459.55	183.79	304.43	1791.26	0.00	3626.13	1814.50
	Other Administrative Expenses	10489.63	170.80	43.83	0.00	21.01	234.17	415.31	61.98	191.00	2955.84	0.00	1865.46	4530.23
	Other Agencies Total Expenses	**15754.77**												
	Establishment Expenses	2557.14	82.21	0.00	0.00	444.85	380.98	108.08	368.55	0.00	298.82	0.00	686.08	187.57
	Other Administrative Expenses	13197.63	87.50	0.00	0.00	833.98	18.20	281.96	218.74	6.15	123.95	0.00	11389.30	237.85
(iii)	**Other Revenue Expenditure**	**29409.79**												
	Training Total Expenses	**8421.07**												
	Establishment Expenses	2922.93	397.69	20.04	0.00	2.16	75.16	5.53	307.96	132.09	822.84	0.00	688.12	471.34
	Other Administrative Expenses	5498.14	184.17	3.00	0.00	4.29	69.92	1.32	244.93	68.17	199.82	0.00	4672.28	50.24
	Commercial Total Expenses	**20988.72**												
	Establishment Expenses	13340.03	102.45	604.13	13.60	176.38	71.58	984.25	237.35	1874.86	3226.83	0.00	3103.01	2945.59
	Other Administrative Expenses	7648.69	51.33	884.62	(0.14)	76.62	78.04	284.86	78.24	2026.03	473.43	2.21	(149.68)	3843.13
	TOTAL C	**77592.28**	**2910.41**	**2237.28**	**802.15**	**1926.14**	**1829.58**	**3079.29**	**2390.77**	**5279.80**	**10913.76**	**170.00**	**29922.37**	**16130.73**

Annexure 18(A):
(Attached to and forming an integral part of Balance Sheet)

FINANCIAL PERFORMANCE OF C-DAC FOR THE FINANCIAL YEAR 2020-21

Amount in Lakhs

S.No	Particulars	Total	Bangalore	Chennai	Corporate	Delhi	Hyderabad	Kolkata	Mohali	Mumbai	Noida	Patna	Pune	TVM
D	**CAPITAL Expenditure**													
(i)	**Expenditure from GIA for Core R&D**	**152.71**												
	GIA General	152.71	0.00	0.00	3.81	0.00	0.00	(1.31)	0.00	3.04	0.00	147.17	0.00	0.00
	Core Grant Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(ii)	**Expenditure from GIA for Sponsored Proj.**	**11883.34**												
	MeitY	4044.56	96.50	34.20	0.00	0.00	44.29	54.08	86.91	129.75	198.70	0.00	2205.09	1195.04
	Other Agencies	7838.78	1.67	0.00	0.00	0.00	476.18	19.46	18.83	0.00	5.00	0.00	7282.30	35.34
(iii)	**Expenditure from Own Funds**	**621.83**												
	Training	186.12	18.06	0.00	0.00	0.00	0.00	0.00	1.51	15.04	1.27	0.00	135.87	14.37
	Commercial	435.71	0.99	0.81	0.00	54.60	0.00	20.39	6.41	33.08	170.36	0.00	48.87	100.20
	TOTAL D	**12657.88**	**117.22**	**35.01**	**3.81**	**54.60**	**520.47**	**92.62**	**113.66**	**180.91**	**375.33**	**147.17**	**9672.13**	**1344.95**
E	**REFUND / TRANSFER OTHER ADJUSTMENTS**													
(i)	**From GIA for Core R&D**	**0.00**												
	GIA General	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Core Grant Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(ii)	**From Sponsored Projects**	**3161.01**												
	MeitY	5204.97	2.22	22.68	0.00	3.04	2233.16	22.96	18.05	99.40	90.50	0.00	1177.61	1535.35
	Other Agencies	(2043.96)	0.19	0.00	0.00	0.00	3.61	81.48	9.06	0.00	(15.00)	0.00	(2123.86)	0.56
	TOTAL (E)	**3161.01**	**2.41**	**22.68**	**0.00**	**3.04**	**2236.77**	**104.44**	**27.11**	**99.40**	**75.50**	**0.00**	**(946.25)**	**1535.91**
F	**TOTAL Expenditure (C+D+E)**	**93411.17**	**3030.04**	**2294.97**	**805.96**	**1983.78**	**4586.82**	**3276.35**	**2531.54**	**5560.11**	**11364.59**	**317.17**	**38648.25**	**19011.59**
G	**Unspent Balance / Surplus / Deficit (A+B-F)**													
(i)	**Grant -in- Aid**	**(1075.63)**												
	GIA General	682.26	0.00	(0.00)	0.00	0.00	0.00	0.00	0.00	(0.00)	0.00	682.26	0.00	0.00
	Core Grant Projects	(1757.89)	0.00	0.00	0.00	(800.71)	0.00	0.00	0.00	0.00	0.00	0.00	(485.92)	(471.26)
(ii)	**Sponsored Projects**	**93014.79**												
	MeitY	54606.40	913.78	0.30	0.00	147.85	3103.35	458.01	(1.71)	656.06	9668.94	0.00	33568.50	6091.32
	Other Agencies	38408.39	281.90	0.00	0.00	1829.75	1054.25	271.90	690.39	(9.41)	415.37	39.10	33665.18	169.96
(iii)	**Other**	**5910.87**												
	Training	1235.69	(373.59)	1.28	46.35	(3.71)	31.98	(6.12)	205.29	(113.62)	320.49	0.00	1438.82	(311.48)
	Commercial	4675.18	10.24	(63.49)	38.86	(29.17)	278.31	(502.81)	241.69	(724.81)	2499.29	12.39	1292.67	1622.01

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CDAC

Centre for Development of Advanced Computing, Pune
CONSOLIDATED ANNUAL ACCOUNTS 2020-21

Annexure 18(B):

CENTRE WISE BALANCE SHEET AS AT 31st March 2021

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

Amount in Lakhs

Particulars	Total	Bangalore	Chennai	Corporate	Delhi	Hyderabad	Kolkata	Mohali	Mumbai	Noida	Patna	Pune	TVM
CORPUS/CAPITAL FUND AND LIABILITIES													
Corpus/Capital Fund	43,836.31	1,990.24	(54.50)	2,159.56	1,967.95	3,457.35	1,427.82	4,473.67	(1,544.40)	17,262.05	12.39	11,707.97	976.21
Reserves and Surplus	31,287.42	470.39	130.35	16.79	2,784.11	1,684.68	295.25	237.55	322.28	587.27	114.42	14,937.02	9,707.30
Earmarked and Endowment Funds	91,999.19	1,197.72	1.08	-	1,177.50	4,157.61	729.93	688.69	648.04	10,084.29	721.36	66,802.97	5,790.00
Current Liabilities and Provisions	48,797.17	484.67	653.29	52.41	593.02	274.90	842.41	601.28	4,510.81	3,256.21	9.84	11,618.74	25,899.59
Branch & Divisions	(0.00)	388.89	176.42	(328.38)	27.07	15,611.78	(101.45)	1,254.44	(70.31)	(45.47)	(8.89)	(15,854.22)	(1,049.87)
Total	**2,15,920.09**	**4,531.91**	**906.64**	**1,900.38**	**6,549.65**	**25,186.32**	**3,193.96**	**7,255.63**	**3,866.42**	**31,144.35**	**849.12**	**89,212.48**	**41,323.23**
ASSETS	-	-	-	-	-	-	-	-	-	0.00	-	-	-
Fixed Assets													
Acquired out of Own Funds	3,646.98	490.39	8.59	-	278.98	59.90	96.53	114.28	95.17	1,041.57	-	1,264.16	197.41
Acquired out of Grant in Aid	18,980.02	153.48	34.20	16.79	2,784.06	948.53	230.69	74.41	59.89	316.59	114.42	8,645.73	5,601.23
Acquired out of Project Grants	12,307.40	316.91	96.16	-	0.05	736.15	64.56	163.14	262.39	270.68	-	6,291.29	4,106.07
Investments-Others	5.05	-	-	-	-	-	-	-	-	5.05	-	-	-
Current Assets, Loans, Advances etc.	1,80,980.64	3,571.13	767.69	1,883.59	3,486.56	23,441.74	2,802.18	6,903.80	3,448.97	29,510.46	734.70	73,011.30	31,418.52
Total	**2,15,920.09**	**4,531.91**	**906.64**	**1,900.38**	**6,549.65**	**25,186.32**	**3,193.96**	**7,255.63**	**3,866.42**	**31,144.35**	**849.12**	**89,212.48**	**41,323.23**
	-	-	-	-	-	-	-	-	-	(0.00)	-	-	-

CENTRE WISE INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st March 2021

Amount in Lakhs

Particulars	Total	Bangalore	Chennai	Corporate	Delhi	Hyderabad	Kolkata	Mohali	Mumbai	Noida	Patna	Pune	TVM
INCOME													
Income from Sales/Services	31,464.05	152.51	1,425.26	-	131.75	310.97	656.71	995.28	3,087.84	6,424.56	14.61	10,049.52	8,215.04
Grants/Subsdies	13,344.52	1,496.36	526.16	788.69	244.00	420.70	539.33	689.23	677.07	1,020.97	850.05	4,041.67	2,050.28
Fees/Subscription	2,048.36	115.16	7.33	-	2.75	63.71	0.46	87.07	86.64	417.16	-	1,166.82	101.26
Interest Earned	2,899.48	102.53	2.48	98.14	88.00	226.95	108.36	217.15	72.68	698.66	39.10	587.79	657.64
Other Income	153.72	0.20	14.51	0.53	2.69	3.38	0.59	15.01	15.55	3.97	-	5.51	91.78
Prior Period Income	4.76	-	-	-	1.40	-	-	0.94	-	(1.66)	-	0.53	3.56
Increase/(decrease) in stock of Finished Goods and Work-in-progress	(1,211.50)	1.90	-	-	-	-	-	-	-	-	-	(764.97)	(448.43)
Total	**48,703.39**	**1,868.66**	**1,975.74**	**887.36**	**470.58**	**1,025.70**	**1,305.46**	**2,004.69**	**3,939.78**	**8,563.66**	**903.76**	**15,086.88**	**10,671.12**
EXPENDITURE													
Establishment Expenses	28,375.70	1,960.51	1,129.33	681.10	401.54	546.45	1,506.80	1,213.54	2,666.06	5,049.64	112.72	7,676.80	5,431.21
Other Administrative Expenses	13,838.67	240.47	902.76	116.54	84.61	158.18	277.25	306.17	2,021.14	525.55	57.28	5,317.94	3,830.76
Prior Period Expenses	(655.89)	-	4.30	4.51	5.14	-	-	13.83	49.30	0.03	-	(764.65)	31.64
Depreciation (corresponding to Schedule 5)	512.69	31.03	1.57	-	12.16	10.77	30.34	24.16	41.72	168.66	-	125.30	66.98
Total	42,071.17	2,232.01	2,037.95	802.16	503.46	715.40	1,814.39	1,557.71	4,778.22	5,743.89	170.01	12,355.39	9,360.59
Transferred to / (from) Balance of Core Grants	721.36	-	-	-	-	-	-	-	-	-	721.36	-	-
SURPLUS / (DEFICIT)	**5,910.87**	**(363.34)**	**(62.21)**	**85.20**	**(32.88)**	**310.30**	**(508.93)**	**446.98**	**(838.44)**	**2,819.77**	**12.39**	**2,731.49**	**1,310.53**

Consolidated Receipts and Payments for the year ended 31st March 2021

Amount in ₹ *Amount in ₹*

Receipts	2020-21	2019-20	Payments	2020-21	2019-20
I. Opening Balance			**I. Expenses**		
a) Cash on hand	69,638	99,475	a) Establishment Expenses	1,49,89,60,596	1,13,81,22,079
b) Bank Balances			b) Administrative Expenses	52,72,23,119	68,29,14,228
i) In Savings/Current Accounts	1,54,56,82,528	1,79,21,25,476	c) Payment made to Creditors for Goods and Others	1,72,28,47,030	3,63,03,83,071
II. Grants Received			**II. Payments made against funds for various projects** (Name of the Fund or Project along with the particulars of payment made for each project shown in separate schedule)	30,67,70,490	27,01,40,980
a) From Government of India	1,14,24,58,673	1,17,09,06,957			
b) Grant and Other Income Received for Projects	4,83,04,29,309	8,43,56,97,691	**III. Investments and Deposits made Progress**	7,87,97,48,705	10,63,57,22,169
III. Income from Encashment of FDRs	6,45,49,15,099	3,45,27,56,607			
IV. Interest Received			a) Purchase of Fixed Assets	5,39,20,301	3,72,97,148
a) On Bank Deposits	56,50,82,094	25,27,46,708	b) Expenditure on Capital Work in Progress	-	7,96,240
b) Loans and Advances	2,33,187	1,81,38,768	**V. Refund of Surplus money/loans**	-	-
V. Other Income (Specify)			**VI. Finance Charges (Interest)**	-	27,284
a) Previous years Income recovered	17,53,964	5,39,271	**VII. Other Payments (Specify)**	-	-
b) Advances Received from Customers	74,13,76,181	1,16,48,42,345	a) Deposit (Assets)	20,51,22,918	21,48,83,476
d) Fees/Subscription & Direct Income	55,44,58,052	1,18,44,47,183	b) Loans and Advances	27,21,15,558	56,77,82,593
e) Other Income	62,39,60,975	51,16,13,628	c) Previous years outstanding payments	3,75,85,13,116	2,24,53,33,611
f) Amount Received from Debtors	1,74,41,76,774	3,02,66,68,490	d) Prepaid Expenses	2,13,07,968	98,45,081
g) Loans and Advances Recovered	20,71,36,389	17,82,05,299	e) Branch and Divisions	5,24,72,48,485	2,69,97,25,362
VI. Amount Borrowed			f) Deposits (Liabilities) Refunded	1,79,91,564	3,79,61,649
Branch and Divisions	4,98,86,11,308	2,43,68,90,221	**VIII. Closing Balance**		
Bank Loan	-	-			
VII. Any Other Receipt (Give Details)			a) Cash on hand	2,577	69,638
a) Deposits (Liabilities)	9,91,55,438	9,10,09,018	b) Bank Balances		
b) Addition to Reserve Fund	-	-	i) In Savings Accounts	2,08,74,49,506	1,54,56,82,528
Total	**23,59,92,21,933**	**23,71,66,87,137**	**Total**	**23,59,92,21,933**	**23,71,66,87,137**
	-	-			

AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
M/S. Lahoti Kasat & Co. (FRN: 105509W)
CHARTERED ACCOUNTANTS

CA Yugandhar Budati
Director Finance (I/C)

Sunil Misar
Registrar (I/C)

Col. A. K. Nath (Retd.)
Director General (I/C)

CA Rohit Kasat
Partner (M.No.151410)
UDIN : 21151410AAAADV4397
Place : Pune , Date : 30-Oct-2021

National Supercomputing Mission (NSM)

C-DAC Telemedicine Solution

Concept :

The term "aesthetics" is well known in everyday-speech and we use it to refer to anything visually beautiful and pleasing to our eyes. Aesthetics has been termed as the measurement of beauty. Every year Media & Communication group of C-DAC is presenting a different C-DAC Annual Report cover page. This year we are showcasing concept of "Aesthetics in Data visualization". Aesthetics has been identified as a key factor to engage a viewer. Therefore the more aesthetically a graphic is perceived, the longer the viewer will try to decode the meaning of it or extract a certain information. Several works of research propose that enhancing the artistic merit of a visualization can result in a more effective and more productive visual analysis. There is more to the display than efficiency of communicating data perhaps sometimes using general metaphors. Here the visualization appears like a hot air balloon hovering over the data mountains.