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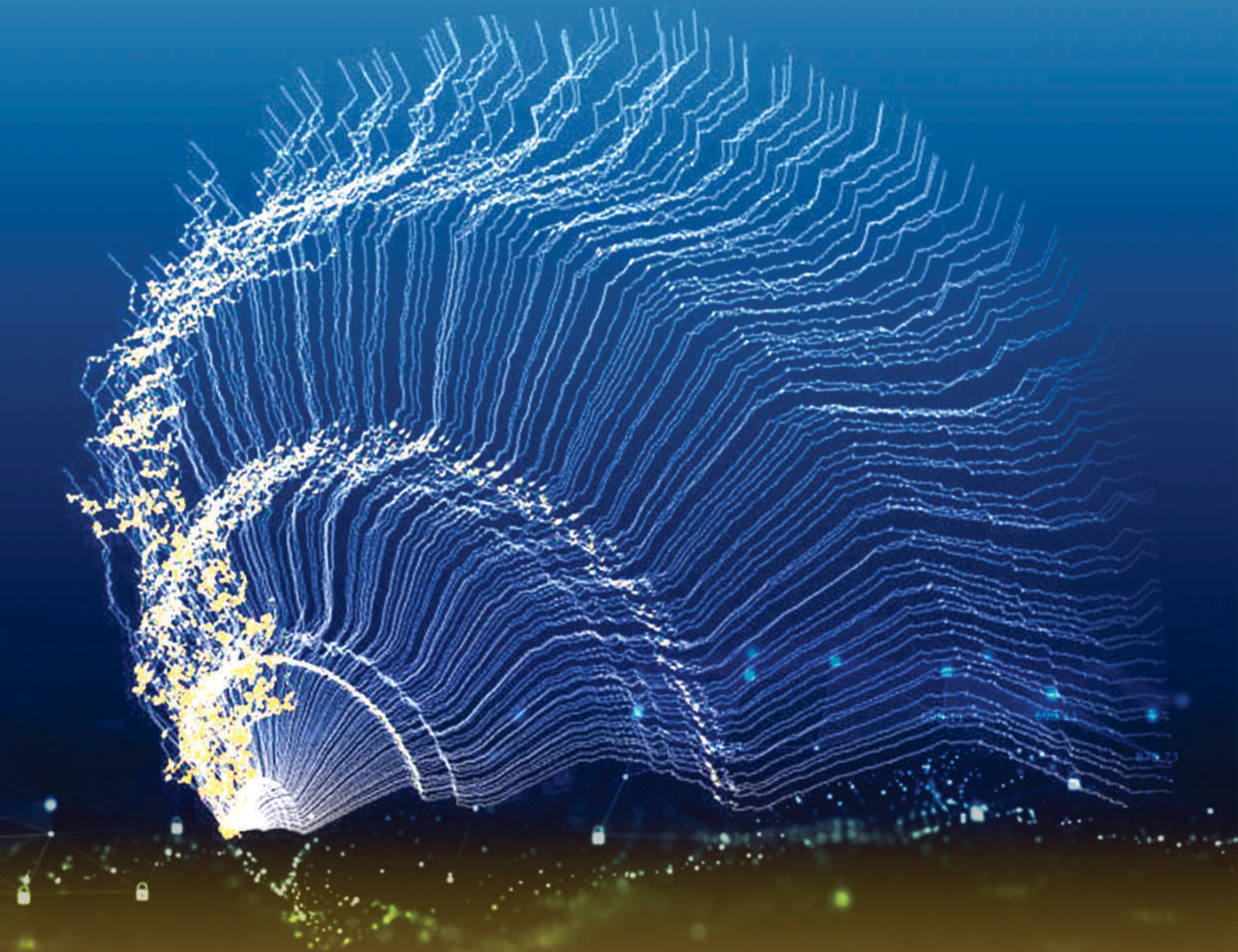
# ANNUAL REPORT 2021-2022



CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

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

# Governing Council

(As on 31st March 2022)

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# Contents

# Overview

C-DAC has accomplished several technological achievements, organized events for the overall benefit of the group of stakeholders, and received multiple recognitions in the year 2021-22. Aadhaar Authentication and the e-KYC platform provided to IOCL were launched as part of the Ujjawala Yojana 2.0 in August 2021 by Shri Narendra Modi, Honourable Prime Minister of India. PARAM Seva (838 TFlops), installed at IIT Hyderabad (IITH), was inaugurated by Shri Dharmendra Pradhan, Hon'ble Union Minister of Education on August 18, 2021 to use HPC in Climate Change, multiscale modelling, additive manufacturing, smart mobility, cyber physical systems, and health care. PARAM Smriti (838 TFlops) supercomputing facility at National Agri-Food Biotechnology Institute (NABI), Mohali was inaugurated by Dr. Jitendra Singh, Hon'ble Minister of State for the Science and Technology and Earth Sciences on November 2, 2021. PARAM BioInferno cluster with a peak compute performance of 147.5 TF to support high memory Genomics applications was launched by Shri Rajeev Chandrasekhar, Hon'ble MoS (IT) during the Azadi ka Amrit Mahotsav (AKAM) event during November 29, to December 05, 2021. ParaDE v1.0 an Integrated Development Environment (IDE) for creating parallel applications on HPC platforms was released by Shri Sanjay Dhotre, Hon'ble MoS on April 13, 2021.

Under Phase-II of National Supercomputing Mission, five supercomputing facilities were established namely, PARAM Utkarsh (838 TFLOPS) at C-DAC Bangalore, PARAM Pravega (3.3 PFLOPS) at IISc Bangalore, PARAM Smriti (838 TFLOPS) at NAABI Mohali, PARAM Seva (838 TFLOPS) at IIT Hyderabad and PARAM Ganga (1.66 PFLOPS) at IIT Roorkee. Indigenous Rudra server has been benchmarked with HPC and Cloud applications and found to be at par with commercial systems. PARAM Trinetra cluster, based on Trinetra-A hardware (100Gbps, 3D torus topology) was made operational with applications from multiple domains validated. It ran Industry standard HPL (High Performance Linpack) benchmark with peak performance of 7.065 TFLOPS, successfully gaining entry in 'Top Supercomputers-India' listing for January 2022 (www.topsc.in) with a rank of 62. Trinetra-A with C-DAC's indigenous Rudra server forms the basis of completely indigenous supercomputing systems which are expected to be ready shortly. C-DAC's National PARAM Supercomputing Facility (NPSF), PARAM Yuva II utilization has remained above 90%. Usage of NPSF's HPC services has been acknowledged in 448 publications and 69 PhDs so far. About 1288 users including 301 PhD scholars across 139 institutions executed their jobs on PARAM Yuva II for scientific research covering many cross functional domains. As a part of capacity building under NSM, more than 11,000 participants were trained in HPC through Hands-on sessions in online mode. In association with IISc Bengaluru and IIT Roorkee, C-DAC is developing a quantum-computing toolkit to build the capability/capacity in QC research in the nation. C-DAC along with Indian Institute of Technology, Madras (IIT-M) and Society for Electronic Transactions and Security (SETS), Chennai are building a solution towards Post Quantum Cryptography & Quantum Cryptanalysis.

C-DAC has deployed several solutions under Multilingual Computing such as Interactive Voice Response (IVR) service in Bangla and English, Text to Speech system for Punjabi Language, Pilot on Machine Assisted Translation (MT) system to facilitate translation (text-to-text) from English to Hindi language and vice-versa for the daily proceeding of Lok Sabha. Also, MAchiNe assisted Translation (MANTRA) Tool deployed at Rajya Sabha Secretariat is used for translations of documents from English to Hindi language during the Parliamentary session. C-DAC is contributing towards activities related to Universal Acceptance and Multilingual Internet. In Digital Preservation and Heritage Computing, C-DAC has deployed Interactive and Intelligent Museum at Science City Kolkata in December, 2021. C-DAC has also developed a framework and necessary technology for creating an environment to facilitate rapid digitization for 1st to 10th Lok Sabha debates.

As a part of first phase of Microprocessor Development Programme, Linux Bootable VEGA Processor Series (IP cores) comprising of five processors spanning from VEGA ET1031, a 32-bit processor to VEGA AS4161, a 64-bit quad-core processor were developed. 'Swadeshi Microprocessor Challenge 2020', launched by MeitY to popularize the indigenous processors, has been a success with many participating teams including start-ups designing with VEGA ET1031 and VEGA AS1061 microprocessors. The first fully indigenous VEGA microprocessor-based SoC chip 'THEJAS32' fabricated,

assembled on the indigenously designed ARIES development boards and board bring-up completed successfully. Emergency Response Support System (ERSS) is continuing its successful journey with 28 states and 8 Union Territories on board, seamlessly delivering emergency services to citizens. C-DAC has been entrusted with the responsibility to execute Design Linked Incentive (DLI) Scheme on behalf of Government of India to achieve significant indigenization in semiconductor, electronic products and IPs deployed in the country by facilitating import substitution and value addition in electronics sector. C-DAC has indigenously designed and developed a total networked charging solution for Electric Vehicle (EV) as per BEVC AC-001 specification and AIS-138 standards. TETRA Digital Network based on C-DAC TETRA Network has been deployed for various strategic sectors, Smart Water Hackathon, etc. It is also installed at Bhabha Atomic Research Centre (BARC), Mumbai in December 2021.

C-DAC has customized secure BOSS for the Indian Coast Guard for internet-facing machines. Total 4192 departments/ agencies were integrated using Mobile Seva platform. A total of 60347 beneficiaries are registered through Jammu & Kashmir's (J&K) e-service platform in the various Social Assistance Scheme of J&K. Revenue of Rs. 63544 Crore was generated for the Government by 262 projects initiated through Online MSIPS (e-MSIPS) platform. GeoSadak 2 is being utilized by all the State Government departments and the Ministry of Rural Development to track the proposals for new roads, up-gradation, monitoring, and management. Vehicle tracking and fleet management solution for Kerala State Civil Supplies Corporation (SupplyCo) has geo-tagged 14503 locations and 2011 routes with 595 vehicles to monitor the door-to-door delivery of food grains under the Public Distribution System (PDS). C-DAC along with STQC & BIS formulated Indian standard for Accessibility in ICT and Part-I Requirements (IS 17802 Part 1): 2021 has been gazetted in December 2021.

C-DAC's e-Sign service- Online Digital signing service- offered more than 4.85 Crs signatures to various online authentication eSign agencies. More than 115 agencies are currently leveraging the facility of eSign 2.1. More than 1.8 crores Authentication/e-KYC are performed using Aadhaar Authentication and the e-KYC platform platform deployed at IOCL Data Center. Web Security Information and Event Management solution (WebSIEM) has been deployed at Indian Oil Corporation Ltd. & HARTRON (DITECH, Haryana). Total of 25000+ users have downloaded and installed M-Kavach 2 - comprehensive mobile device security solution. C-DAC is developing a Unified Blockchain Framework for offering "National Blockchain Service" and creation of a "Blockchain Ecosystem". Cyber Forensics solutions were upgraded & deployed for key agencies in India. C-DAC is actively contributing towards Setting-up and Operation of Forensics Labs for the Supreme Court, Government of India, Forensic Science Laboratory for Jammu & Kashmir and Cyber Police Station in Kerala. C-DAC actively contributed towards Information Security Education Awareness (ISEA) activities through various awareness workshops.

Around 1072 online OPDs have been set up on eSanjeevaniOPD and more than 29,000 doctors have been registered on this platform with 7.4 million consultations in 35 states. As part of National Health Mission, eSanjeevaniHWC, Doctor-to-Doctor telemedicine system has been implemented at around 45,114 Spokes, 4070 Hubs and over 91,606 paramedics and doctors have been trained and on boarded till now. e-Sushrut - Hospital Management Information System has been deployed at various hospitals including 715+ Indian Railway Hospitals across India and many of the AIIMS center all over the India. Also, e-Sushrut application has been made compliant for Ayushman Bharat Digital Mission (ABDM). More than 2,71,927 patients have already been served through SeHATOPD's that is functional till March 2022. With inclusion of OSMCL Odisha & Lakshadweep e-Aushadhi deployment tally has increased to 29 Instances in India this year covering 22 States, 2 Union Territories, 5 National Program under MoHFW. The Aakanksha system is an indigenously developed Radiation Treatment Planning System (TPS) is deployed in Tata Memorial Cancer Hospital (TMC), Mumbai. C-DAC's SNOMED CT Toolkit (CSNOtk) v7.0 supports more API parameters to support received filtered and precise search results.

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 across 100 cities for more than 9.5 lakh candidates. C-DAC has also conducted Coast Guard Enrolled Personnel Test (CGEPT) for Navik and Yantrik categories of Indian Coast Guard across 75 cities with total 6,12,862 candidates registered. Under FutureSkills Prime program, bridge courses in Artificial Intelligence and AR-VR are offered by C-DAC and more than 6.36 lakhs IT Professionals have signed up and over 3.23 Lakh course enrolments have been done. An instance of the Process Automation for Competitive Exams (PACE) solution is deployed for GATE, JAM, and NBE and catered to around 9 Lakh candidates.

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 2021-22.

# Major Activities in Thematic Areas

## High Performance Computing and Quantum Computing

C-DAC has been on 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 National Supercomputing Mission (NSM) approved in 2015 by Cabinet Committee on Economic Affairs (CCEA). Activities in Quantum Computing includes QSim – Quantum Simulator, Centre for Excellence in Quantum Technology and Metro Area Quantum Access Network (MAQAN).

A summary of activities carried out by C-DAC through commissioning of indigenous series of PARAM supercomputers during 2021-22 in this thematic area is given herein.

### National Supercomputing Mission (NSM)

Under NSM (approved by Cabinet Committee on Economic Affairs (CCEA) in 2015), C-DAC is entrusted with the responsibility of development of Indigenous Supercomputing ecosystem in a phased manner: from "Assembly" to "Manufacturing" to "Design and Manufacturing" of HPC systems. The purpose of this ecosystem is to carry out frontier research in design and development of HPC Components (HPC processor, Server node, Interconnect switch, Cluster, and Liquid cooling system), HPC System Software, HPC Applications, and HPC Solutions and Services along with deployment of peta-scale computing infrastructure across the country. NSM aims for complete self-reliance in the field of HPC. The systems deployed under NSM are dedicated to the scientific community of the country.

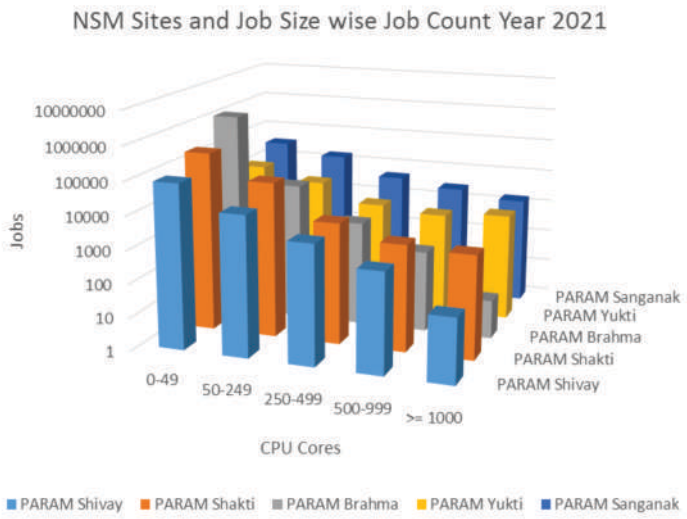
The Mission plans to build and deploy 24 facilities with cumulative compute power of 64 Petaflops. Until now, C-DAC has deployed 11 systems at IISc, IITs, IISER, JNCASR, NABI and C-DAC under Phase-1 and Phase-2 with a cumulative compute power of more than 20 Petaflops. Three systems consisting of PARAM Shivay (838 TFLOPS) at IIT BHU, PARAM Brahma (1.7PFLOPS) at IISER Pune, and PARAM Shakti (1.66 PFLOPS) at IIT Kharagpur under Phase-1. PARAM YUKTI (1.8 PFLOPS) at JNCASR Bangalore, PARAM Siddhi-AI (5.2 PFLOPS/ 210 PLOPS (AI)) at C-DAC Pune, PARAM Utkarsh (838 TFLOPS) at C-DAC Bangalore, PARAM SANGANAK (1.66 PFLOPS) at IIT Kanpur, PARAM Pravega(3.3 PFLOPS) at IISC Bangalore, PARAM Smriti (838 TFLOPS) at NABI Mohali, PARAM Seva (838 TFLOPS) at IIT Hyderabad and PARAM Ganga (1.66 PFLOPS) at IIT Roorkee under Phase-2 are operational, and four systems PARAM Ananta (838 TFLOPS) at IIT Gandhinagar, PARAM Porul (838 TFLOPS) at NIT Trichy, PARAM Kamrupa (838 TFLOPS) at IIT Guwahati, and PARAM Himalaya (838 TFLOPS) at IIT Mandi are at site. These systems cater to computational demands of academia, researchers, MSMEs, and startups in areas of national importance.

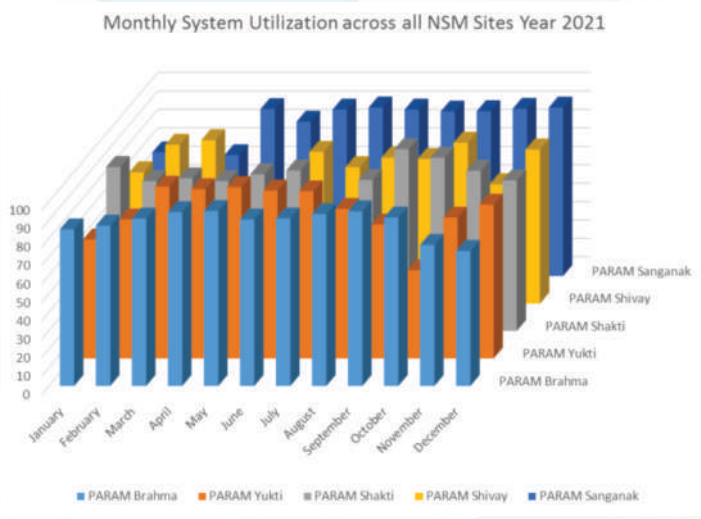
Considerable number of components utilized in building Phase-2 systems are manufactured and assembled within India, which is a step in the direction of making India 'Atmanirbhar'. These systems use C-DAC's HPC Software Stack developed indigenously. A wide range of applications from scientific & engineering and data science domains are optimized for the underneath architecture of these systems. The facilities under Phase I and II along with systems under Phase-III will be accessed by thousands of active researchers, academicians on Nation Knowledge Network (NKN).

## HPC System Deployments and Technologies

During the year, five supercomputing facilities are established under NSM - PARAM Utkarsh (838 TFLOPS) at C-DAC Bangalore, PARAM Pravega (3.3 PFLOPS) at IISC Bangalore, PARAM Smriti (838 TFLOPS) at NAABI Mohali, PARAM Seva (838 TFLOPS) at IIT Hyderabad and PARAM Ganga (1.66 PFLOPS) at IIT Roorkee.

As of March 2022, more than 3600 users across the nation from nearly 100 academic and scientific institutions had successfully run more than 36,00,000 computational jobs on the eleven NSM Supercomputing systems and resulted in more than 200 publications..




*NSM Utilization Statistics*

### PARAM Pravega

**PARAM Pravega is one of the most powerful supercomputers in India with a compute power of 3.3 PFlops and the largest in Indian academic institutions. It is designed to power diverse research pursuits at premier science research institution IISC Bangalore. It is a mix of heterogeneous nodes with Intel Xeon Cascade Lake processors for the CPU nodes, and NVIDIA Tesla V100 cards on the GPU nodes. The system has storage of 4 Petabyte with a high-performance parallel file system and archival subsystem. Areas of research include COVID-19 and viral diseases, simulation of turbulent flows for green energy technologies, study climate change and associated impacts, analysis of aircraft engines and hypersonic flight vehicles etc.**


*PARAM Pravega*

### PARAM Utkarsh

PARAM Utkarsh (838 TFlops) is set up at Terascale Supercomputing Facility (CTSF) located at C-DAC Bangalore. It supports HPC simulations, Big Data Analytics, and Cloud services mainly to meet the requirements of the Micro, Small, and Medium Enterprises (MSME) sector. MSME has little in-house expertise and limited access to HPC specific hardware. NSM fills this gap and makes it easier for MSME sectors to support their ideas, simulations, and application implementation using PARAM Utkarsh. PARAM Utkarsh helps to enhance the MSME business model to the next level of digital transformation.


*PARAM Utkarsh*

### PARAM Smriti

PARAM Smriti (838 TFlops) is installed at National Agri-Food Biotechnology Institute (NABI). NABI aims at catalyzing the transformation of Agri-food sector in India. HPC system was inaugurated by Dr. Jitendra Singh, Hon'ble Minister of State for the Science and Technology and Earth Sciences on November 2, 2021. It will harness biotechnological tools in Agriculture Biotechnology, Food, and Nutritional Biotechnology to provide sustainable and novel solutions for quality food and nutrition.


*Param Smriti*

### PARAM Seva

PARAM Seva (838 Tflops), installed at IIT Hyderabad (IITH), was inaugurated by Shri Dharmendra Pradhan, Hon. Union Minister of Education on August 18, 2021. IITH to use HPC in Climate Change, multiscale modeling, additive manufacturing, smart mobility, cyber physical systems, and health care. IITH has identified projects such as, Water Purification with Nano Tubes, Design & Optimization of outer-space Hypersonic Vehicle, Telesurgery with true 3D visualization, and 3600 National Security Analytics.


PARAM Seva

## PARAM Ganga

The major research areas that would be making extensive use of PARAM Ganga (1.66 PFlops), installed at IIT Roorkee, are AI, ML/DL, Weather Research & Forecasting, Geosciences, Molecular Dynamics, Ground motion simulation, Material science, Chemistry, and Computational Biology. The system facilitates computational power to the user community of IITR and neighbouring institutions.


*PARAM Ganga*

## PARAM BioInferno

PARAM BioInferno cluster with a peak compute performance of 147.5 TF is a Big Data cluster with 1 Petabyte HDFS based local storage across compute nodes. To support high memory Genomics applications, it has a Bull Sequana X808 SMP node with 6TB RAM. It was launched by MOS Shri Rajeev Chandrashekhar during the Azadi ka Amrit Mahotsav (AKAM) event.


*PARAM BioInferno*

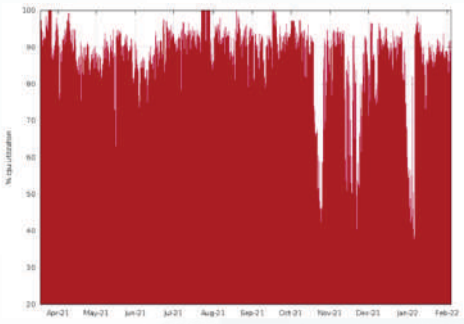
### PARAM Shavak

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 catalyze research using modeling, simulation, and data analysis. During 2020-21, PARAM Shavak systems were deployed at IIITKDM Kurnool, University of Burdman, West Bengal, DIAT Pune and NASSCOM-DSCI, New Delhi.

### PARAM Yuva II

C-DAC's National PARAM Supercomputing Facility (NPSF), PARAM Yuva II has been used by scientists and engineers for research. The utilization of NPSF has remained above 90%. Usage of NPSF's HPC services has been acknowledged in 448 publications and 69 PhDs so far. About 1288 users including 301 PhD scholars across 139 institutions executed their jobs on PARAM Yuva II for scientific research covering many cross functional domains.


*PARAM Yuva II*



*System utilization*

## HPC Facilities

### ICAR-IASRI

C-DAC continued working with ICAR-IASRI for upgradation and maintenance of its supercomputing infrastructure.

### India Namibia Centre of Excellence in IT (INCEIT)

Through Ministry of External Affairs (MEA), C-DAC has set up a HPC cluster PARAM ARUB at INCEIT at Namibia University of Science & Technology (NUST) in Windhoek, Namibia to boost development of ICT in Namibia. In view of the COVID-19 pandemic, a 5-days HPC workshop was conducted in online mode for the scientists and researchers of Namibia in July 2021.

### India Jordan Next Generation Centre of Excellence in IT (IJCoEIT)

Through Ministry of External Affairs (MEA), C-DAC has commissioned PARAM Shavak 'Supercomputing-in-a-box solution' at IJCoEIT at Al-Hussein Technical University (HTU) in Amman, Jordan. To enable use of PARAM Shavak system, an introductory 2-days workshop on HPC and ML/ DL was conducted in online mode for the scientists and researchers of Jordan in August 2021 during the COVID-19 pandemic.

## Build Approach Developments under NSM

### Indigenous Rudra Server

Phase-3 Supercomputing systems under build approach of NSM, are planned to be built using Rudra server. Rudra server is designed to serve usage models including HPC, AI, Cloud, and enterprise solutions. Rudra Server has a peak

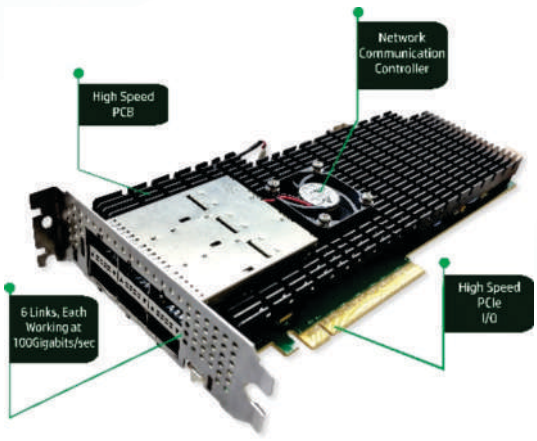
performance of 3.68TF to 34 TF based on configuration. A 6 nodes pilot cluster with peak computer of 127 TF is setup based on Rudra servers. Various HPC applications and cloud benchmarks were executed on the pilot cluster, which were found to be at par with cluster deployed with commercial servers.


*Rudra based Pilot System*

## Indigenous HPC Network – Trinetra

C-DAC's Trinetra is targeted at self-reliance in HPC technology development. Trinetra network development encompasses complex chip design (NCC: Network Controller chip), Platform design (PCB development), and Lightweight Protocol networking software design. Development effort is split in multiple phases, with an aim of technology mastering, creating real world products, and leveraging on know-how, to plan for future Indigenous Exascale network design.

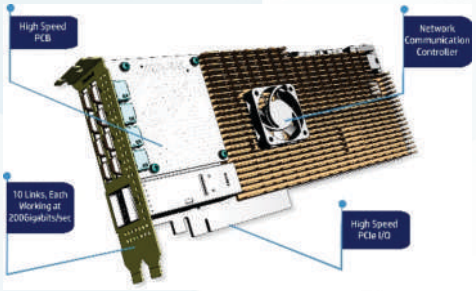
PARAM Trinetra cluster, based on Trinetra-A hardware (100Gbps, 3D torus topology) was made operational with applications from multiple domains validated. These include IMB (MPI validation and stress testing benchmark), WRF (weather modelling), GROMACS/LAMMPS (molecular dynamics), OpenFOAM (computational fluid dynamics), etc. It ran Industry standard HPL (High Performance Linpack) benchmark with peak performance of 7.065 TFLOPS, successfully gaining entry in 'Top Supercomputers-India' listing for January 2022 (www.topsc.in) with a rank of 62. The design team is currently optimizing hardware and software components to improve performance and efficiency of the network. Trinetra-A with C-DAC's indigenous Rudra server forms the basis of completely indigenous supercomputing systems which are expected to be ready shortly.




*Trinetra-A NIC (100Gbps, 3D Torus)*

*15-node test cluster*

C-DAC is also developing next generation Trinetra-B using state of the art physical link and host interface technologies. It incorporates ten bidirectional 200 Gigabits/sec channels, capable of aggregate fabric interface capability of 4 terabits/sec. The architecture uses 'cascaded hypercube' topology aimed towards providing good performance at local cluster level, while maintaining scalability using 'supercluster' approach. Network Interface Card (NIC) design for Trinetra-B has been completed.



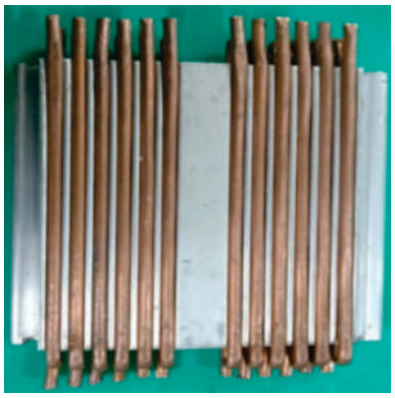

*Trinetra-B 3D model*

*Trinetra-B Prototype NIC*

### Design and Development of Direct Contact Liquid System (DCLC)

A 30-kW modular PWC_A&IEC (Panel Water Cooler with Provision of Air and Indirect Evaporative Cooling) was designed, developed, and fabricated at Heat Pump Laboratory at IIT Bombay. The PWC_A&IEC cools the warm liquid generated from a DCLC based HPC system. The 30-kW system is being installed at IISER, Pune for cooling of PARAM Brahma.

*30-kW PWC_A&EC System*



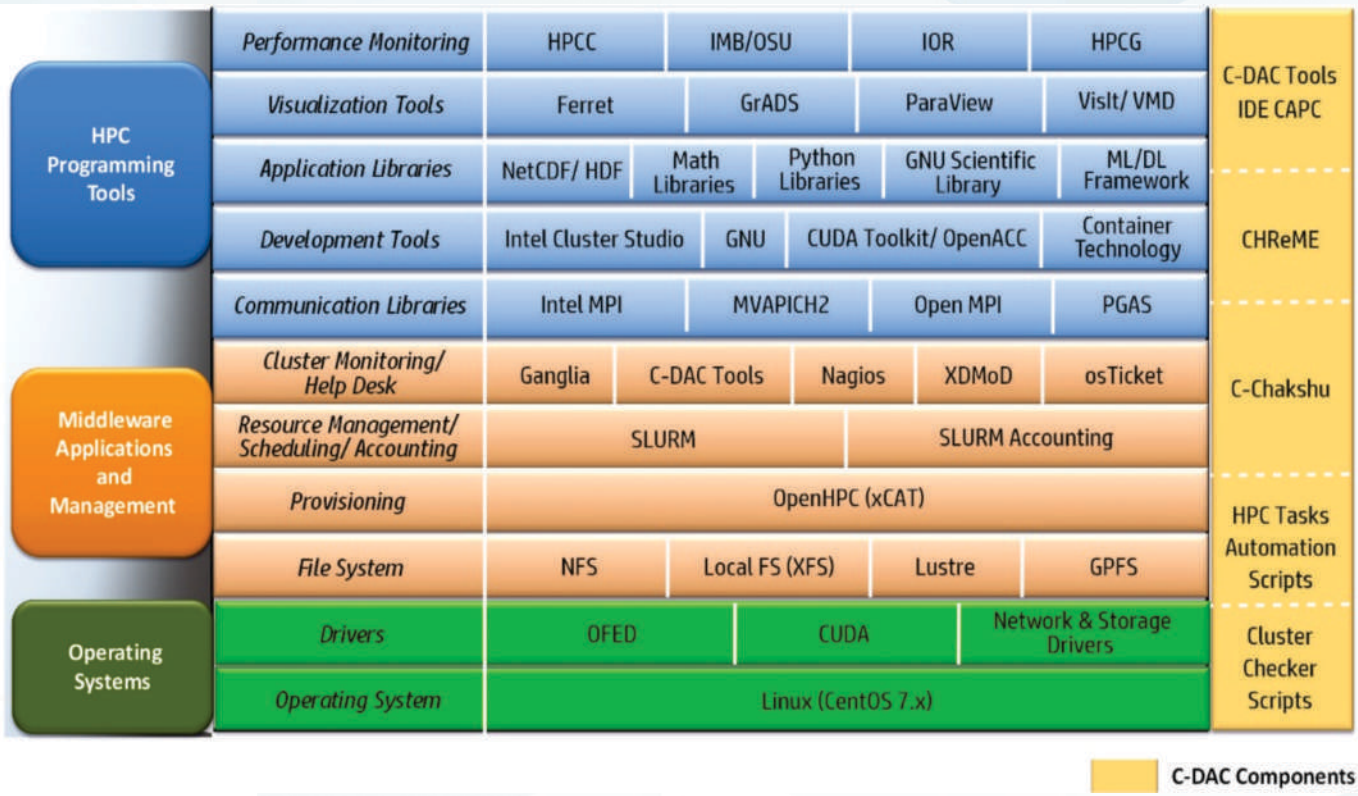
*360-W coil on chip-based cooling system*

A modular Coil-on-Chip Liquid Cooling System, COC_LC, was designed to extract heat loads up to 360-W from a 50 mm x 50 mm base. A CFD model for COC_LC was developed to investigate its thermal performance for various configurations. The CFD simulations helped in optimizing the configuration of chip liquid cooling system. The optimized cooling system was fabricated at the Heat Pump Laboratory at IIT Bombay. The thermal performance of the COC_LC system is being evaluated experimentally at Vishwakarma Institute of Technology (VIT), Pune. The COC_LC is being deployed at actual Rudra server at C-DAC Pune in which heat dissipation requirement is of the order of 165 W for each processor.

## HPC System Software

### C-DAC's HPC software Stack (CHCS)

For effective use by user community, NSM systems provide a C-DAC's HPC software Stack (CHCS). CHCS is a novel solution from C-DAC, based on a customized open-source software stack with value-added indigenous tools, technologies, and scripts from C-DAC. It automates the process of the systematic build, deployment, and management of HPC and AI-based systems.




**Components of C-DAC's HPC Software Stack (CHCS)**

### Multi-Cluster Monitoring Platform C-CHAKSHU [v3.0]

C-Chakshu is a HPC multi cluster monitoring and Management platform which 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 researchers and scientists of varied domain to run their applications with minimal efforts.

### CHReME [v4.0]

C-DAC HPC Resource Management Engine portal is an end-user job submission, management and monitoring tool that works with various schedulers such as Torque, OpenPBS, Sun Grid Engine, Moab, Load leveler. It is designed to increase cluster utilization by bringing more users to cluster who would stay away due to the complexity of submitting jobs to a cluster.

### Parallel Development Environment (ParaDE) [v1.0]

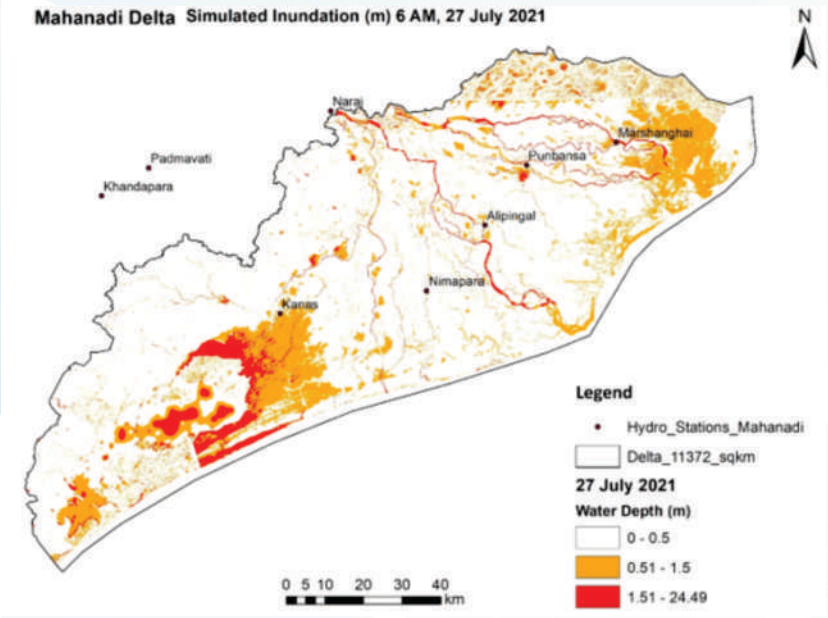
ParaDE is a parallel development environment for creating parallel applications on HPC platforms. Being web based, it helps to access HPC irrespective of geographical location and carry out complete software development from compiling, debugging, automatic job submission and project management, using multiple parallel paradigms such as OpenMP, MPI, etc. 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. ParaDE v1.0 was released by MoS for IT, Shri. Sanjay Dhotre on April 13, 2021.

### C-DAC's Automatic Parallelizing Compiler (CAPC) [v2.0]

CAPC is an innovative solution that automatically parallelizes sequential code to different types of target parallel hardware without any inputs/contribution from the user. It liberates the application developer from complexities of learning new parallel paradigms to write parallel programs for multicore and GPU parallel architectures. The released version of CAPC converts to parallel paradigms of OpenMP 3.0, OpenCL/ OpenMP 4.5 to support multicore CPUs and GPUs. CAPC v2.0 with multicore and GPU parallelization capabilities was released by MoS for IT, Shri. Sanjay Dhotre on April 13, 2021.

## Applications Developments under NSM

### Early Warning System for Flood Prediction for River Basins of India




It is being implemented for Mahanadi River Basin at the behest of the user agency Central Water Commission (CWC). The flood prediction for the Mahanadi River Basin was carried out during the flood season from June to September in 2021. The delta region with an area of 11,500 sq. km and the mid-Mahanadi region with an area of 51,000 sq. km were considered for the simulation on HPC systems. The model was fed with barrage & dam discharges, rainfall, and tidal heights.

### Multi-Sectorial Simulation Lab and Science Based Decision Support Framework

The prediction of urban events involves high resolution (1 km to a few meters) microscale modelling and very local cross-disciplinary data. It needs online coupling and inter-operable data for studying extreme events occurred over urban cities.

### Setup of WRF Model to Forecast Heavy Rainfall Events over Pune City

The purpose of Weather Research and Forecasting (WRF) model to forecast heavy rainfall over Pune city and evaluate the impact of Planetary Boundary Layer (PBL) on rainfall simulated by the model. Domain size and location were found to play important role in rainfall simulation over Pune city due to proximity of Western Ghats. The WRF model version 4.1.5 was used to simulate heavy rainfall events witnessed over Pune. The present analysis indicated that the QNSE scheme has performed better compared to the other four PBL schemes in simulating the magnitude as well as the spatial distribution of rainfall over Pune city. The identified model setup is applied for two more heavy rainfall events and the results are found to be satisfactory.

### Insertion of High-Resolution Sentinel Data into WRF Model

The USGS derived LULC information, prepared during 1992-93 suffers from two types of errors, viz. misclassification of urban category data and non-availability of updated data. An experiment was performed to ingest high resolution Sentinel (10m) LULC data in to WRF model along with AWiFS (~925 m) data. It impacted the surface temperature.

### Impact of Urbanization on Heat Wave

The simulation was carried out to evaluate the performance of WRF model in predicting heat wave events that was witnessed over Ahmedabad city during 18-20 May 2016 and 01-03 June 2019. It was done by simulating at a high resolution of about 1 km using GFS (~25 km) spatial resolution as initial conditions for 00 UTC. The result showed MYJ schemes is a better in simulating the required cases.

### Early Urban Flood Warning System for Pune

The development of a coupled modeling system to improve urban flood forecasting. The HEC-HMS Pune basin model was developed with 10m CartoSat DEM from NRSC. Rainfall-Runoff simulation has been carried out for heavy rainfall events in the Mula Mutha catchment for the year September 2019, October 2020 and July 2021. The model output has been validated with observed data at Dattawadi and Bundgarden stations obtained from Water Resource Department, Pune and subsequently the calibrated model is being used for simulating heavy rainfall events.

### Air Quality Forecasting System over 5 Cities and Air Quality Research

An air quality forecasting system over Indian urban cities is being set-up. The forecasting system will be ingested with local high resolution emission inventory to replace the global emission inventory input to WRF-Chem model. Emission inventory generation for Pune is ready for 2x2 Km and being upgraded to 400 x 400 m. whereas, sampling for chemical speciation of particulate matter (PM2.5) has been done at 5 places in Bangalore city during winter season of 2020.

### Impact of PM2.5 on Urban Heat Island during Nation-Wide Lockdown for Covid19 Pandemic

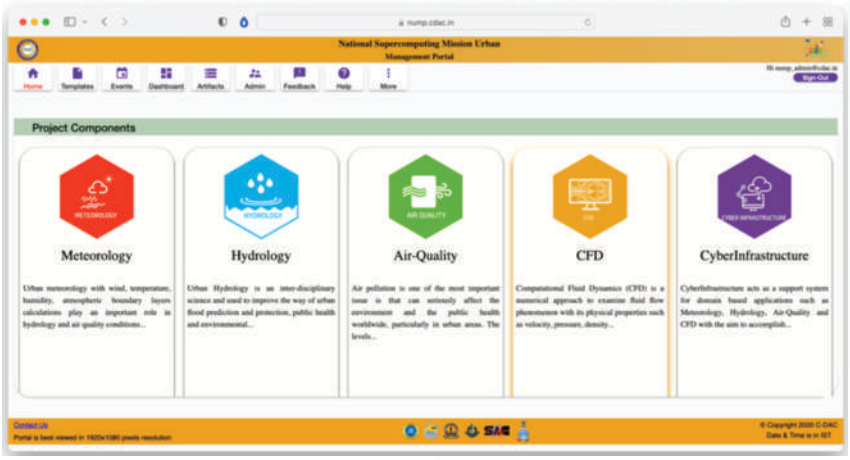
PM2.5 mass concentrations and air temperatures were analysed to investigate the impact of emission reductions due to the nationwide lockdown (global COVID-19 pandemic) on the Urban Heat Island (UHI) over urban and suburban areas in Delhi region. The PM2.5 levels were reduced by 38 to 50% and 50 to 57% over suburban and urban areas respectively during lockdown period of 2020 compared to those of before lockdown periods (2019 and 2020). As a result, UHI with hourly, minimum and maximum temperatures have strengthened by around 2°C, 3°C and 4°C respectively. The reduced PM2.5 levels over urban and suburban areas in Delhi region due to COVID-19 pandemic lockdown corroborates the results of strengthening the diurnal UHI effect and weakening the nocturnal UHI intensity.

### Computational Fluid Dynamics (CFD) Activities on Urban Modelling

The phenomenon of atmospheric flow is characterized by mainly two parameters: large-scale meteorological disturbances and small-scale wind fluctuations produced by surface terrains and roughness elements. 3-D morphology data for Pune city has been incorporated in OpenFOAM. OpenFOAM, an open-source CFD simulation software, has been being used to carry out the micro-scale simulation studies of wind and dispersion of pollutants. The steady state dispersion simulation was used to study a one sq km building area from a single and multi-point source emission have been carried out. The pollution hotspot data obtained from WRF-Chem was given as input to the CFD model and a steady state dispersion of CO emission has been carried out.

### Development of an Automated Model Execution Framework

Under NSM Urban modeling, an automated HPC based weather model execution framework is developed. It facilitates end-users with automated model execution of various models on HPC. This framework provides raw / processed data for researchers, a decision support system (DSS) including what-if scenarios for policy makers, general weather forecasts, warnings for the common man, and a data analytics platform for various stakeholders.



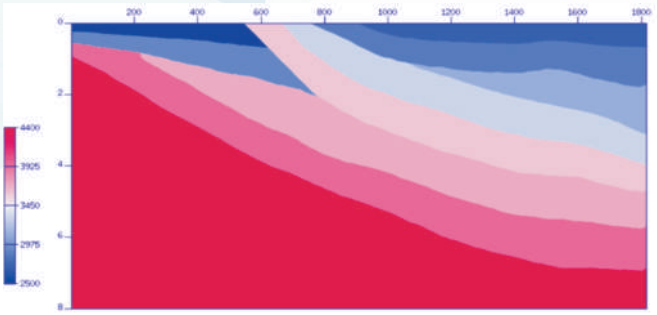

*Automated Model Execution Framework*

### Parallel Computational Fluid Dynamics (CFD) Solver

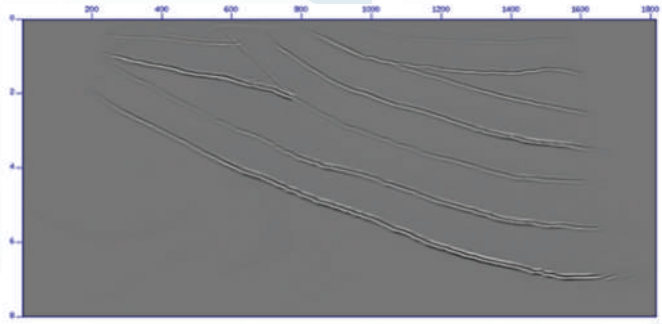
The parallel and scalable coupled CFD model captures an urban representation of micro-scale city environmental conditions. The WRF-Chem modeling environment is set up on Param Sanganak HPC server. The model was configured over Delhi city to simulate Air quality forecasting. The results of the simulated data were analysed and compared with ground based and satellite observations. It was found that the initial results were quite satisfactory but, in some places, the results underestimated.

### A HPC Software Suite for Seismic Imaging to aid Oil and Gas Exploration

Reverse Time Migration (RTM) is highly compute-intensive, and its implementation requires state of the art HPC ecosystem. It is useful for depth imaging for upstream Oil and Gas sector. SeisRTM is an initiative to develop domain specific software, customizable for Indian geological subsurface structures and beneficial for Indian Oil companies for regular production usage.



*Geological subsurface 2D Model*



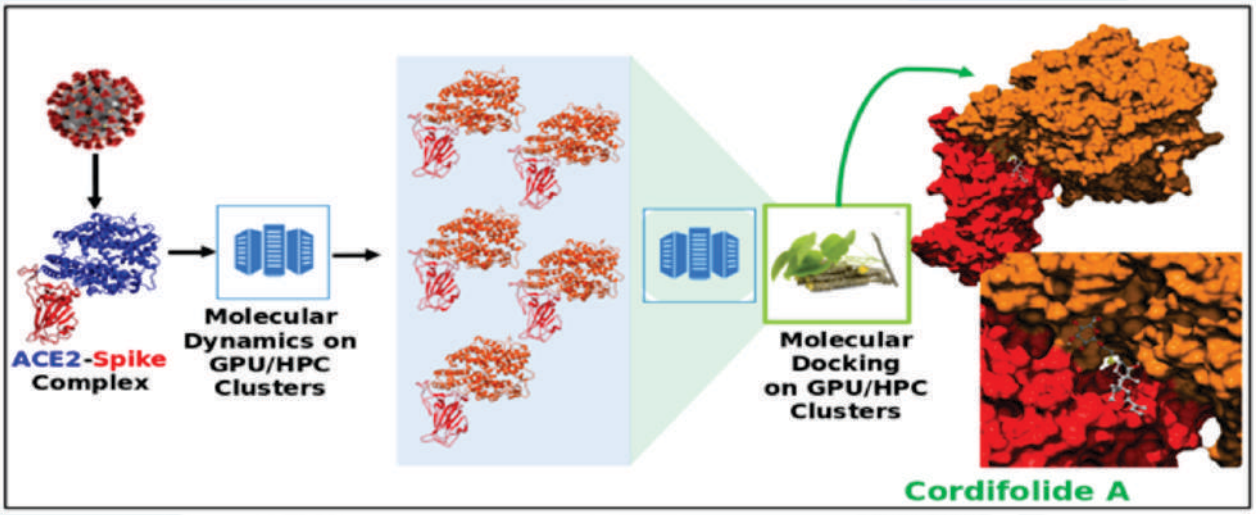
*RTM Outcome – Synthetic model*

### Computational Drug Repurposing Studies on SARS-CoV-2 Proteins using HPC

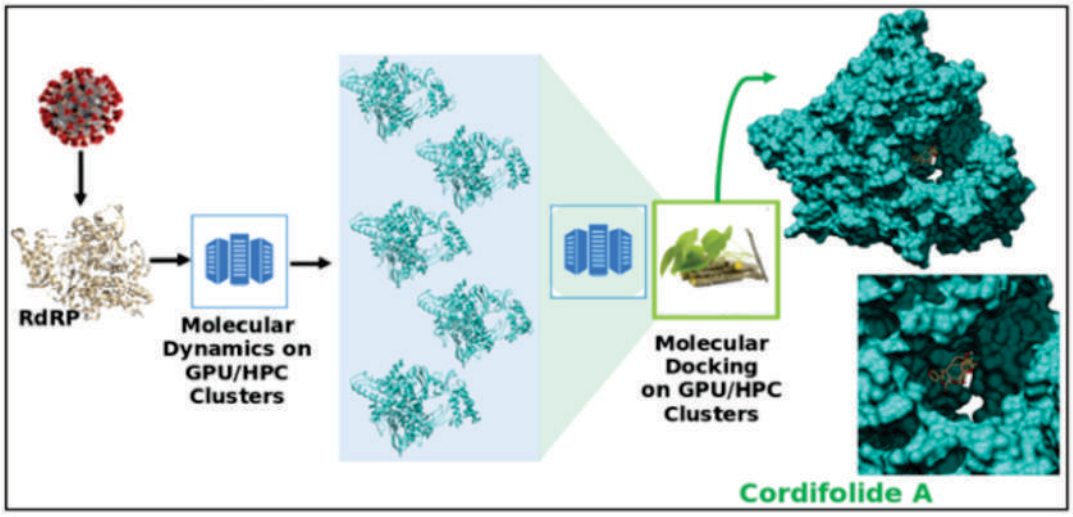
Therapeutic strategies targeting host proteins hold the risk of killing uninfected cells further worsening the medical condition. It demands a need of unique and specific strategies to target viral proteins. One such strategy is drug repurposing or repositioning. Three crucial COVID19 targets viz. RNA polymerase (RdRp), Main protease (3CLpro) and Spike protein which are involved in various functions of coronavirus were studied for drug repurposing.

S-glycoprotein (Spike) of SARS-CoV-2 forms a complex with the human transmembrane protein angiotensin-converting enzyme 2 (ACE2) during infection. It forms first line of contact with the human cell. FDA-approved drugs and phytochemicals from Indian medicinal plants were explored. Molecular docking and simulations of these molecules targeting ACE2–Spike complex were performed. Rutin DAB10 and Swertiapuniside were obtained as the top-scored drugs as per the docking protocol. The MD simulations of ligand-free, Rutin DAB10-bound, and Swertiapuniside-bound ACE2–Spike complex revealed abrogation of the hydrogen bonding network between two proteins. The principal component and dynamic cross-correlation analysis pointed out conformational changes in both the proteins unique to ligand-bound systems. The interface residues, His34, and Lys353 from ACE2 and Arg403, and Tyr495 from Spike protein formed significant strong interactions with ligand molecules, inferring the inhibition of ACE2–Spike complex.

Drug repurposing studies targeting inhibition of RNA dependent RNA polymerase (RdRP) of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) have exhibited the potential effect of small molecules. In the present work a detailed interaction study between phytochemicals from Indian medicinal plants and the RdRP of SARS-CoV-2 has been performed. The top four phytochemicals obtained through molecular docking were swertiapuniside, cordifolide A, sitoindoside IX, and amarogentin belonging to Swertia chirayita, Tinospora cordifolia and Withaniasomnifera. The principal component analysis of these systems showed significant conformational changes in the finger and thumb subdomain of the RdRP. Hydrogen bonding, salt-bridge and water mediated interactions supported by MM-GBSA free energy of binding revealed strong binding of cordifolide A and sitoindoside IX to RdRP. Hence, these phytochemicals may hold potential to act as RdRP inhibitors owing to their stability in binding to the druggable site.



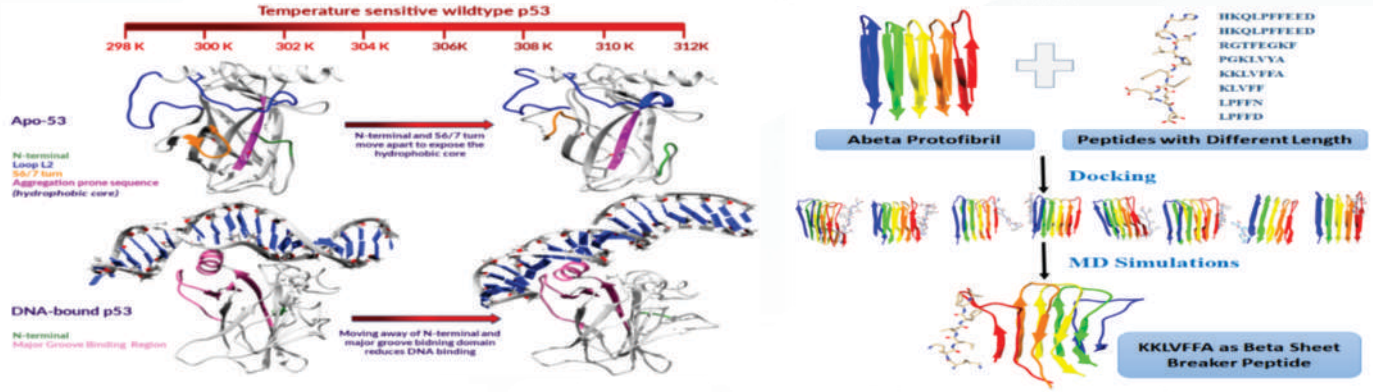

*Phytochemicals and FDA-approved drugs targeted against ACE2–Spike complex*




*RdRP structure in the cupped right-hand form bound to Cordifolide A*

## MD simulations of Cancer Proteins

MD simulations of wild type and three of cancer mutants in p-loop were simulated. Multiple sets of simulations (GTP bound, and GDP bound) were carried out to understand effect of mutation on activation cycle of KRas protein. Temperature sensitive nature of p53 explored through multi microsecond length MD simulations. PCA and MSM reveal different conformations of p53 explored through temperatures.




*MD Simulation of Cancer Proteins*

### Amyloid Studies

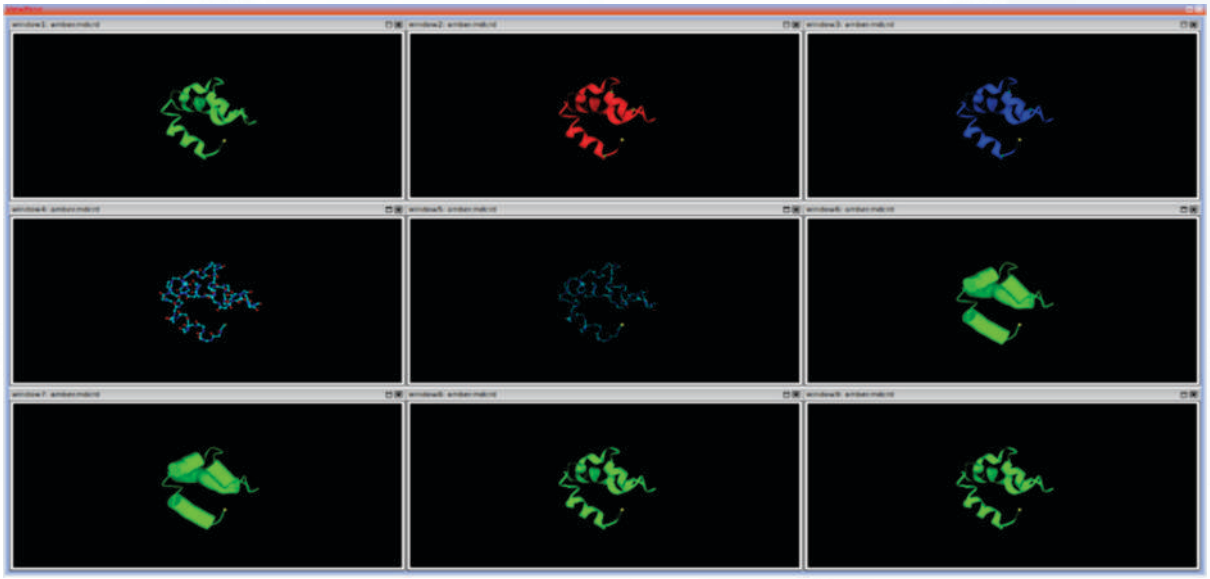
Alzheimer's disease is characterized by amyloid-β aggregation. Currently, all the approved medications are to treat symptoms but there is no clinically approved treatment for the cure or to prevent the progression of Alzheimer's disease (AD). Earlier reports suggest the use of small molecules and peptides to target and destabilize the amyloid fibril. Use of Beta Sheet Breaker (BSB) peptides seems to be a promising and attractive therapeutic approach as it can strongly bind and destabilize preformed amyloid fibril. There are experimental studies describing the destabilization role of various BSB peptides, but the exact mechanism remains elusive. In the current work, an attempt was made to study the destabilization mechanism of different BSB peptides on preformed amyloid protofibril using molecular docking and simulations.

### ChIPseq-RNAseq Integration Analysis

Breast cancer is one of the leading causes of cancer in women all over the world and accounts for ~25% of newly observed cancers in women. Epigenetic modifications influence differential expression of genes through non-coding RNA and plays a crucial role in cancer regulation. In the present study, epigenetic regulation of gene expression by in-silico analysis of histone modifications using chromatin immunoprecipitation sequencing (ChIP-Seq) was carried out. Histone modification data of H3K4me3 from one normal-like (MCF10A) and four breast cancer cell-lines (Luminal-A: MCF7, ZR751 in TNBC: MB231, MB436) were used to predict miRNA expression at the promoter level. Predicted miRNA promoters (based on ChIP-seq) were used as a probe to identify novel gene targets.

### DPICT: MD Visualization and Analysis Tool for Molecular Simulation and Visualization

DPICT is Advanced Molecular Dynamics Visualization & 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. It visualizes on multiple windows in a single view for different or same trajectory files. It supports maximum of 9 windows for trajectories. Synchronous operations can be performed for selected trajectories in a different window. Carrying out multiple analyses at the same instance for multiple trajectories helps in comparison of the trajectories.



*Visualization of Molecule*

### CIMULATE

MD simulation is a computer simulation of motion of atoms in a system. It is based on application of Newtonian dynamics to study time evolution of atoms and molecules to defined thermodynamic environment. CIMULATE is a MPI based parallel application for simulation of biomolecules. It would be useful in studying various biological evants which involves study of motion of bio molecules such as protein folding/misfolding. The algorithm for bio-molecular dynamics simulation includes various sub algorithms and methods like PME, verlet algorithm, leapfrog algorithm, pressure and temperature coupling etc.

### Genetic diversity of 'Very Important Pharmacogenes' in two South-Asian Populations

Reliable identification of population-specific variants is important for building single nucleotide polymorphism (SNP) profile. In this study, genomic variation using allele frequency differences of pharmacologically important genes for Gujarati Indians in Houston (GIH) and Indian Telugu in the U.K. (ITU) from the 1000 Genomes Project vis-à-vis global population data was studied to understand its role in drug response. Joint genotyping approach was used to derive variants of GIH and ITU independently. SNPs of both these populations with significant allele frequency variation (minor allele frequency $\geq 0.05$) with super-populations from the 1000 Genomes Project and gnomAD based on Chi-square distribution with p-value of $\leq 0.05$ and Bonferroni's multiple adjustment tests were identified. Population stratification and fixation index analysis was carried out to understand genetic differentiation. Functional annotation of variants was carried out using SnpEff, VEP and CADD score.

### Genetic Diversity of Mycobacterium Africanum using Phylogenetics and Population Genomics

Mycobacterium var. africanum (Maf), a member of the Mycobacterium Tuberculosis Complex (MTBC) is responsible for causing tuberculosis in West Africa. Regions of difference (RDs) are usually used for delineation of MTBC, however with growing data availability, single nucleotide polymorphisms (SNP) may provide further resolution. To understand the genetic diversity of Maf, population genomics and phylogeny approaches were used.

### Genetic Diversity of Mycobacterium Bovis using Phylogenetics and Population Genomics

Bovine Tuberculosis (bTB) presents a significant economic burden and is a One-health issue. Despite the implementation of several control programs through testing and culling, occurrences of bTB have been on the rise. This is explained through the existence of several wildlife species which act as reservoir hosts and are responsible for transmitting bTB to cattle. This study aims to understand the genetic diversity of Mycobacterium bovis using population genomics and phylogeny approaches.

### Performance Evaluation of Variant Calling Tools for Human and Microbial Genomes

Three popular read aligners viz. BWA-MEM, Bowtie2 and NovoAlign were used for the human genome benchmark dataset of Genome in a Bottle (GIAB). Variant calling was performed using four popular variant callers. For microbial genomes, BWA-MEM was used for reference mapping followed by variant calling along with FreeBayes and PILON. Predicted variants were assessed in terms of true positives, false positives, and false negatives. Consensus approach was used for identifying SNPs (predicted by more than one variant calling pipeline) in false positive dataset that satisfied threshold criteria to be included as true positives. Precision and Recall were measured for evaluating each of the variant calling pipelines. Predicted variants were validated by comparing with gold standard data which aided in improved identification of actionable high confidence variants, reduced prediction of false positives. This approach proved to be valuable for prioritization of actionable variants.

### Application Porting, Optimization and Scaling Services in HPC/DL under NSM

HPC applications from bioinformatics, molecular dynamics, climate modeling, weather prediction and disaster management along with DL software stack were ported and enabled across NSM sites. Spack, a package manager to install scientific software on supercomputers was made available on NSM systems. Using Spack, one can build a software stack in Python or R, link to libraries written in C, C++, or Fortran, and easily swap compilers or target specific microarchitectures. Efforts were made to optimize ANUGA code by porting it from Python2 to Python3 and use of various parameters. A subset of SeisAcoMod2d, a parallel 2D acoustic finite difference seismic modelling using staggered grid, was ported on one API (dpcpp).

| HPC Applications | |
|---|---|
| **Bio-informatics** | MUMmer, HMMER, MEME, PHYLIP, mpiBLAST, ClustalW |
| **Molecular Dynamics** | NAMD (CPU & GPU), LAMMPS(CPU & GPU), GROMACS |
| **Material Modeling, Quantum Chemistry** | Quantum-Espresso, Abinit, CP2K, NWChem, |
| **CFD** | OpenFOAM, FDS, SU2 |
| **Weather, Ocean, Climate** | WRF, RegCM, MOM, ROMS |
| **Disaster Management** | ANUGA Hydro |

### Large Scale Model of the Himalayan Crust

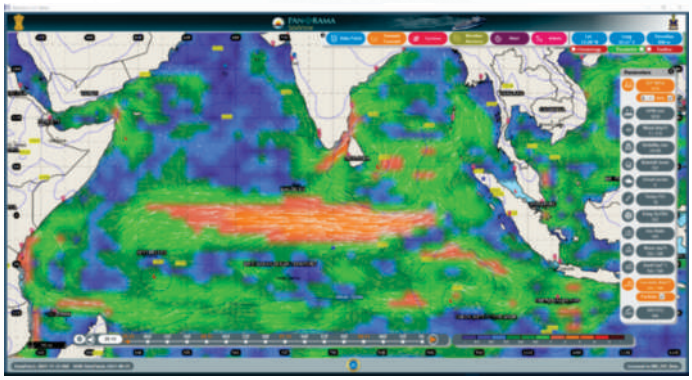
Large scale model of the Himalayan crust using finite difference modeling of high and low frequency nearfield data and its effect on strong ground motion in central seismic gap region of Himalaya was developed. Himalayan region is one of seismically active region. This is mostly used for earthquake related studies. P-wave imaging is affected by bulk modulus of medium and thus affected by fluids. SH-wave imaging depends only on density and shear modulus of medium and thus is independent of water content. SH-wave imaging provides much higher resolution than P-wave Imaging. SH Modeler was developed and tested using elevation data provided by IIT Roorkee.

### Development of Forest Fire Spread Model

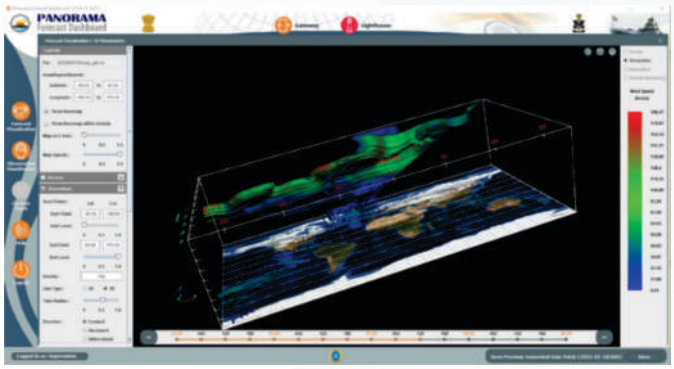
The developed model will be tested against the past fire occurrences in co-ordination with Sikkim Forest Department and it would be used for analysis of various fire spread scenario in Sikkim Forest. In order to develop models for simulation of forest fire spread, different CFD softwares (WRF-Fire, WRF-SFIRE, WFDS and FDS) have been explored and installed on HPC platform at C-DAC. The burnt areas of previous forest fires of Sikkim region have been mapped using satellite data. A CFD model has been developed using WRF-SFire for Maltim region of North Sikkim for grassland fire study. The model has been simulated on 4 nodes of Param Shakti HPC cluster for 15 hour fire spread, and it took 10 hours 35 minutes to complete the simulation. The simulated fire spread area matched well with satellite burnt area.

### Panorama- Advanced Marine Forecast Visualization System (Phase II)

Panorama-II facilitates real-time data download from multiple sources, database management, data compression, multi-parameter visualization (2-D & 3-D), 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 naval command and onboard ships. During this year, several value additions were done like in-house developed & integrated 3-D visualization libraries, integrated climatology data viewer (for both ocean and atmospheric parameters), particle flow animation of ocean vector parameters, performance optimization to minimize data feed/ process & plotting time, revamped user interface of the Lighthouse module, advanced compression techniques for a significant reduction in data patch size, temperature inversion, multi-user scenario with role-based access mechanism, automatic data patch generation, GTS visualization, and cross-platform support.



*Article Flow Depiction of ocean parameters*




*3-D Visualization (Streamlines)*

## NSM Human Resources

2021-22 was overshadowed by the after-effects of pandemic. However, an opportunity was found in the adversity by switching over to online mode. This enabled us to reach out to more participants across the length and the breadth of the country, though providing hands on experience to participants was a challenge. Hands-on sessions were conducted in those programs where the number of participants were limited to 100.Cumulatively, more than 11,000 participants have been trained in HPC, since the beginning of the Mission. A C-DAC HPC Hackathon as a part of worldwide event of OpenACC forum, was held from August 2 – 4, 2021.

The third online course, titled "Introduction to Deep Learning", was launched jointly by the Nodal Centres at IIT Kharagpur, IIT Madras, IIT Goa and IIT Palakkad. With help of International Co-operation Division of DST, participants from BIMSTEC countries were invited to attend this course. Participants from Afghanistan, Bhutan, Myanmar, and

Sri Lanka attended the course, along with local participants. More than 400 participants attended and certificates were issued.

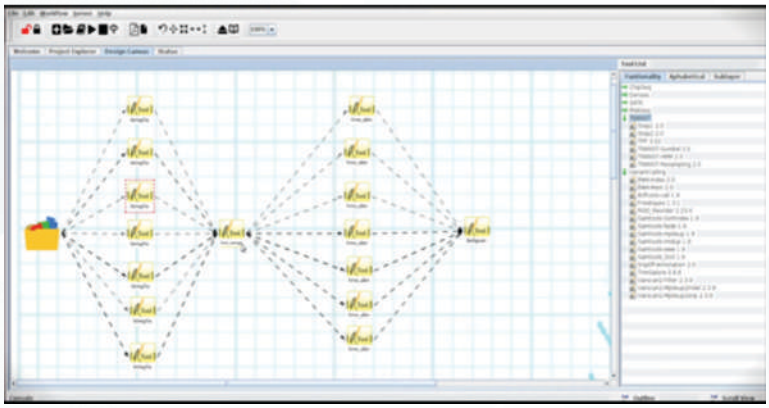
The 7-month online PG Diploma Course, 'e-PGD in AI' was conducted and following 2–4-day workshops were conducted in online mode by the NSM nodal centers:

- Workshop on HPC for Astronomy and Astrophysics
- MPI in action - Unsteady heat conduction solvers
- Workshop on AI and HPC in Semiconductor Manufacturing
- Workshop on HPC and AI for Computational Biology
- Workshop on High Performance Computing in Engineering

## Cloud Computing

### AnvayaNGS - Framework to Accelerate NGS Genomics Data Analysis

AnvayaNGS as an automated software suite dedicated for analysis of Next Generation Sequencing (NGS) data. Four predefined workflows viz. RnaSeq Analysis, de-novo transcript assembly, de novo genome assembly and Transposon sequence data analysis were completed. AnvayaNGS was deployed and tested at IASRI-Delhi. Param Shavak for Brazil client and Param Shavak for Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.



*A snapshot of AnvayaNGS*

### BioAviator

BioAviator is a bundled Bioinformatics Cloud solution. It is developed as a system and framework to address the challenges faced by the bioinformatics researchers and clinicians.

## Big Data and Analytics

### htVAM- A High Throughput Variant Analysis Computational Methodology

htVAM is a computational methodology using HPC clusters for variant calling of multiple samples at a single instance. Multi-sample variant callings have shown to have more advantages than corresponding single-sample variant callings. The aggregate information of all samples is used to improve the sensitivity and precision to detect all DNA changes in a single sample. Results from individual sample are thus enhanced using the information from other samples in the population. Joint variant calling using htVAM has applications in pedigree analysis, for discovery of new biomarkers and in high confidence molecular profile driven diagnosis. It also has direct implications in discovering rare variants associated with Mendelian diseases as sequencing data of the affected individual and his immediate family needs to be analyzed jointly to identify and prioritize variants.

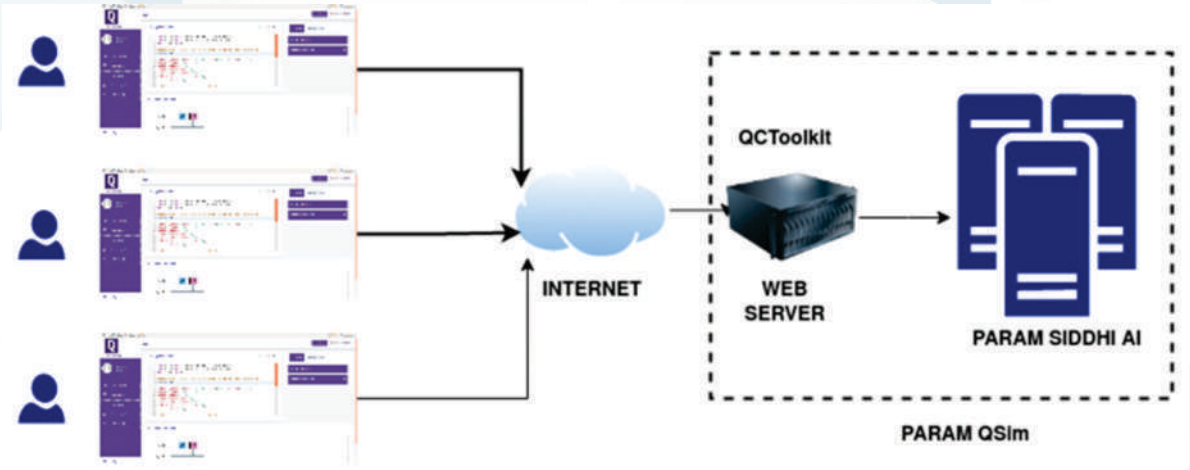
### GAMUT: A Genomics Big Data Management Tool

GAMUT (Genomics bigdAta Management Tool) is a big data-based solution for efficient run-time comparison of SNPs across large datasets based on partition of samples belonging to different populations considering user-defined splits. It is based on client-server architecture with MongoDB at the back end and JSF with Prime Faces as the front-end.

## Quantum Computing and Communications

### Quantum Simulator (Qsim)

In association with IISc Bengaluru and IIT Roorkee, C-DAC has developed QSim- a quantum computing toolkit to build the capability/capacity in QC research in the nation. It shall comprise of QC Toolkit including simulator & workbench, QC Course and QC capacity building. This is the first initiative in India to address the common challenge of advancing the Quantum Computing research frontiers in the country. This initiative provides a playground for anyone passionate to learn or experiment in Quantum Computing - be it students, faculty or researchers. It is accomplished as a collaborative effort of C-DAC, IISc and IIT Roorkee. 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. It was launched on August 27, 2021 by Shri Rajeev Chandrasekhar, Minister of State for Electronics & Information Technology. Govt. of India.




*PARAM QSim Cloud using HPC infrastructure PARAM SIDDHI AI*

### Metro Area Quantum Access Network (MAQAN)

C-DAC along with Indian Institute of Technology, Madras (IIT-M) and Society for Electronic Transactions and Security (SETS), Chennai are building a solution towards Post Quantum Cryptography & Quantum Cryptanalysis. This is covering the network layer of the Quantum Key Distribution (QKD) stack for end-to-end delivery of private keys in a trusted repeater QKD environment. Components include, Software Defined Network (SDN) enabled Quantum Key Distribution (QKD) Stack comprising of SDN enabled QKD routing/switching protocols, SDN Controller for QKD stack, SDN agent for QKD Network Stack, Controller application for QKD Routing/Switching and Controller application for QKD Network Management.

### Centre of Excellence in Quantum Technology

C-DAC in collaboration with Raman Research Institute (RRI), Bangalore and IISc Bangalore is working on the initiatives associated with Centre of Excellence in Quantum Technology. The main objective of this initiative is to build an expertise to perform research and development in the field of Quantum Technology in India. It has started with construction and optimization of its elementary building blocks and finally propose to develop a 4-qubit quantum processor using superconducting transmon architecture. C-DAC aims to focus on the development of a scalable FPGA based quantum control and measurement hardware and complete software framework for quantum measurement hardware.

### Quantum Sensing

C-DAC in collaboration with Tejpur University, Assam is developing a Quantum Optical Sensor to measure the low-level concentration of Arsenic and Lead in drinking water. Sensing of ultra-trace element using quantum sensor is based on the classic experiment of Hong, Ou and Mandel (HOM effect). The operating principle is based on the interference of photons in entangled state. C-DAC is developing the quantum sensor-based array device using commercially available sensors and a software solution for assessment of quality of drinking water.

# Digital India RISC-V (DIR-V) and Strategic Electronics

C-DAC has demonstrated its expertise over the years in developing sophisticated, compact and cost-effective electronic systems for defense, law enforcement agencies, industrial purposes and social empowerment. Technology verticals include the design, development of microprocessor, VLSI systems, embedded solutions, IoT applications, digital signal processing, artificial intelligence and machine learning etc. Primary areas of focus under Professional Electronics include smart system solutions, security & surveillance, power electronics, agri-electronics, medical electronics, strategic electronics and intelligent traffic systems. Details of activities carried out by C-DAC during the year in this thematic area are mentioned below.

## National Level Initiatives

### Digital India RISC-V (DIR) Initiative

#### VEGA Processor

Microprocessor Development Programme under national initiative 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 indigenous processors, has been a success with many participating teams including start-ups designing with VEGA ET1031 and VEGA AS1061 microprocessors. The first prize in Swadeshi Challenge was won by Team- Vega-FCS-FT who used VEGA processor to demonstrate a "Fault Tolerant Reliable Integrated Avionics System for Drones".

The first fully indigenous VEGA microprocessor-based SoC chip 'THEJAS32' fabricated, assembled on the indigenously designed ARIES development boards and board bring-up completed successfully. Applications demonstrated on the ARIES development boards at the first SemiconIndia 2022 Conference, Bangalore. 'THEJAS64', 64-bit SoC chip is being fabricated in the Indian foundry SCL, Chandigarh.


*32-bit THEJAS32 SoC ASIC*

#### RISC-V ISA compliant Floating-Point Unit IP Cores

Floating-Point Arithmetic Unit (Lite and High Performance) IP cores that have been designed by C-DAC are compliant with IEEE 754-2008. The cores support single and double precision floating-point computations with different IEEE 754 standards compliant with rounding modes and exceptions. The IP cores are compatible with RISC-V instruction set and has been architected for integration as arithmetic functional unit in a pipeline of a RISC-V ISA compatible microprocessor. Posit Arithmetic Unit IP core designed by C-DAC is compliant with Posit arithmetic specifications, RISC-V Instruction Set and has been architected to integrate as a functional unit to a RISC-V processor. The Posit IP

arithmetic/core is treated as an alternate for IEEE 754-2008. The core is designed to support parameterized N and ES values enabling half (P16), single (P32) and double (P64) precision Posit computations with various rounding modes.

## National Mission on Power Electronics Technology (NAMPET – III)

### 3.3 kW AC Charger solution for Electric Vehicle (EV)

C-DAC has indigenously designed and developed a total networked charging solution for Electric Vehicle (EV). The solution comprises of an Electric Vehicle Supply Equipment (EVSE), Central Management System (CMS) web portal, and Android mobile application with communication and user interfaces. AC EV Charger is a 3.3-kW charger suitable for charging electric vehicles through Public Metered Outlets installed at office premises, shopping malls, railway stations, etc. The charger has been developed as per BEVC AC-001 specification and AIS-138 standards. The product was launched by Hon. Secretary, Ministry of Electronics and Information Technology (MeitY), Govt. of India in August' 2021 at MeitY.


*3.3 kW AC Charger solution for Electric Vehicle (EV)*

### Battery Emulator for Electric Vehicle (EV) Supply Equipment

C-DAC is developing a silicon carbide (SiC) based battery emulator system for charging 30 kW electric vehicle systems which is suitable for charging a four-wheeler (LMV). Presently available emulators are imported, expensive and proprietary. The proposed system aims at indigenous development and is envisaged to be an affordable solution. The solution has a configurable feature which may support a wide range of EV applications.

### Startup promotion under NaMPET Program

Promotion of startups is one of the thrust areas envisaged in NaMPET phase-III. NaMPET, being a flagship project of MeitY facilitating collaboration of industry, R&D and academics, can play a vital role in developing a start-up ecosystem in the field of power electronics. It is proposed to support the start-up entrepreneur in terms of transfer of technology developed under NaMPET, technical support and consultancy for proto development and testing support from NaMPET-III.

### Emergency Response Support System

ERSS is a public emergency response system (112) to dispatch an Emergency Response Unit on 24x7 to respond to and attend the emergency calls. The system integrates emergency signals from all smart communications like voice calls, SMS, email, and panic signals into a unified platform. Emergency signals are received and processed centrally at State Emergency Response Centre (SERC) and forward them to support services (Police, Fire, Health, Disaster Management and Railways) to render required services to the users. The solution integrates GIS map based tracking and navigation, image and video transmission, inter-State information exchange, tracing of records for victims and crimes etc. The solution facilitates GIS map-based real time mission monitoring and ensures service unit accountability. ERSS is continuing its successful journey with 28 states and 8 Union Territories on board, seamlessly delivering emergency services to citizens.

### Design Linked Incentive (DLI)

Design Linked Incentive Scheme is to achieve self-reliance and Technology Leadership in the Semiconductor Design sector. C-DAC has been entrusted with the responsibility to execute this prestigious scheme on behalf of Government of India. 100 domestic companies of semiconductor design will be nurtured for Integrated Circuits (Ics), Chipsets, System on Chips (SOCs), Systems and IP Cores and semiconductor linked design. This will help in achieving significant indigenization in semiconductor, electronic products and IPs deployed in the country, thereby facilitating import substitution and value addition in electronics sector. This will also help to strengthen the design infrastructure for semiconductor design and facilitating access to Start-ups and MSMEs.

As a part of the same, DLI Portal will be developed to enable start-ups to upload the applications and will facilitate sending of acknowledgements once the application is complete in all respects. C-DAC will establish semiconductor design infrastructure under the scheme either by itself or through other incubator(s) and shall carry out responsibility of setting up National EDA Tool Grid, repository of IP Cores, Hardware and Software License, patents and trademarks, etc. and make them available for start-ups and MSMEs.

## Smart System Solutions

### Coal Dust Suppression Unit (CDSU)

The Coal Dust Suppression Unit is an industrial grade dust monitoring unit which senses the concentration of particulate matter (PM10, PM2.5) in the atmosphere and activates dust suppression sprinklers when the dust content exceeds safe permissible limit. The CDSU has built with 2.4 GHz radio communication to facilitate wireless activation of sprinklers and an Online Monitoring Software (OMS) for visualizing the concentration of PM.

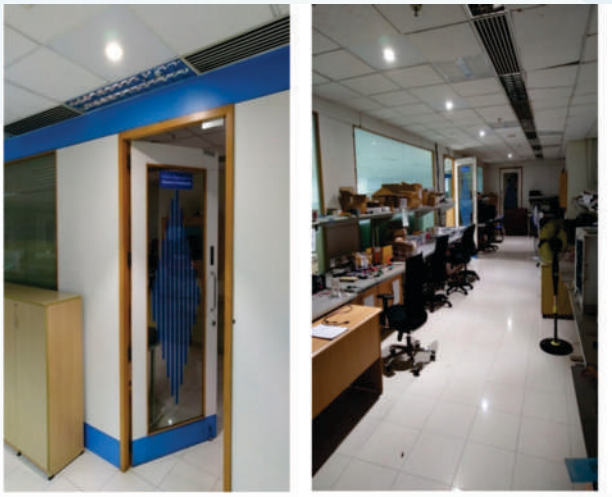

*Coal Dust Suppression Unit (CDSU)*

### Common Smart IoT Connectiv (CoSMiC)

Common SMart IoT Connectiv (CoSMiC) is a software middleware providing open standards and open interfaces for end-to-end communication for deployment of IoT application adhering to oneM2M standard. The CoSMiC architecture ensures interoperability and data exchange between different IOT devices and applications and avoids vendor lock-in. It provides a dashboard page showing IoT units, products, applications, and live data in a Geographical Information System (GIS) map.

### Visible Light Communication based Indoor Positioning System

An indoor positioning system allows users to accurately pinpoint the location of people or assets inside a building using smartphones, mobile devices, tracking tags or other devices. A smart LED down light fitted in ceilings acts as VLC Transmitters and Image sensor in smart phone acts as a VLC Receiver. Each Transmitter will transmit a unique ID which will be received by mobile user using image sensor of smart phone. A smart phone app will decode the ID and communicate with a server to retrieve the exact location, which can be displayed on a map. Indoor positioning systems have vast applications such as product location detection inside large warehouses, indoor navigation services inside large buildings such as museums and shopping malls, location based services and advertisements.



*VLC IPS deployed in Ubicom Lab at C-DAC Chennai*

### Testing Tools for Automated Fare Collection (AFC) system

C-DAC has developed the expertise for indigenous certification of interface specification of National Common Mobility Card NCMC ecosystem which is to be adopted as Indian Standard. The testing and certification tools have been developed by C-DAC for STQC (the Govt. Certification agency) and deployed at STQC Laboratory. The scope of the certification process includes the four interfaces, namely, (a) Transit Service, (b) Terminal – AFC Backend Communication Interface, (c) AFC Ecosystem – Acquirer Interface and (d) Gate – Terminal Interface.

### AI based Analytics Platform for Foodborne Diseases

C-DAC has developed a secured and user-friendly web-platform for data repository and retrieval on Food Borne Pathogens (FBP). This system envisages the development of robust AI-ML based Data Analytics Solution consisting of statistical, non-parametric (neural networks including deep learning methods) and Big Data Analytics methods and context specific dash board based data visualization. This is carried out in association with ICMR, Delhi, ICMR-RMRC, Dibrugarh, Tripura Govt. Medical College GMCH, Guwahati, Manipal Institute of Medical Science, Sikkim, BPGH&TC, Pasighat, Arunachal Pradesh, AIIMS Guwahati, Assam.

## Solution for Agricultural Sector

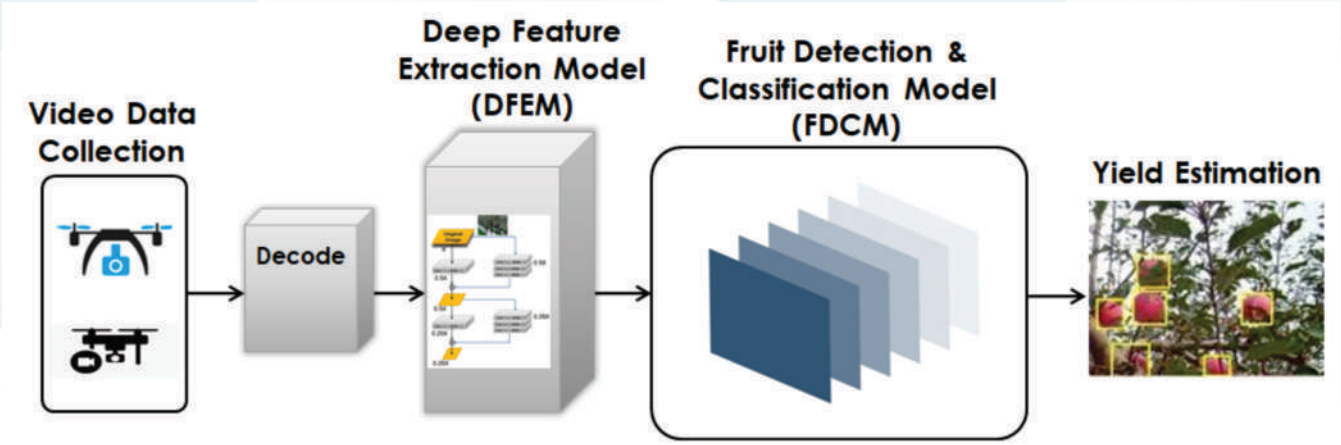
### Acoustic Red Palm Weevil Detector (ARPWD)

Acoustic Red Palm Weevil Detector (ARPWD) is an acoustic sensing device for detection of Red Palm Weevil in the coconut trees with early warning dissemination. The vibrations generated, while the grubs chew inside the trunk of a palm, is captured using highly sensitive vibration sensor. This signal is amplified, filtered and processed for extracting RPW larval bite signature, to identify the presence of RPW larvae.

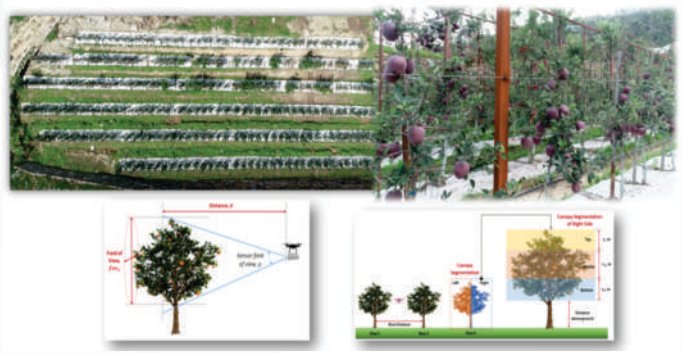
*Acoustic Red Palm Weevil Detector*

### AI based crop yield estimation and diseases detection

C-DAC has developed an Artificial Intelligence (AI) based stream data analytics framework for crop yield estimation and diseases detection using a centralized web interface for information sharing and dissemination. The solution uses an unmanned aerial vehicle (UAVs) mounted with multiple sensors and an imaging device to collect the aerial data of the fruit crop field, soil and other environment parameters. The AI based data analytics framework has been developed for yield estimation, irrigation management and soil nutrient analysis. C-DAC has established a tie-up with ICAR-Indian Agricultural Research Institute, New Delhi, Himachal Pradesh Horticulture Development Society, Shimla and Directorate of Horticulture, Himachal Pradesh for further proliferation of the developed technology.




*AI based data analytics framework for crop yield estimation*



*Crop yield estimation*

## Solution for Strategic Sectors

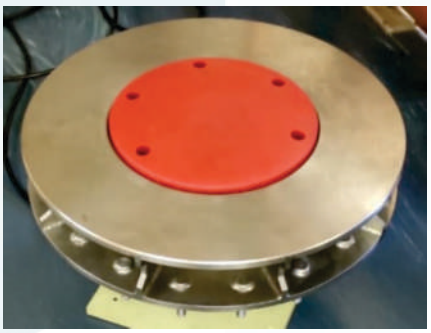
### Magnetically Suspended Momentum Wheel Test Station

The Automated Test Equipment (ATE) for 1553 based Magnetically Suspended Momentum Wheel Test Station is a custom designed ATE Generic Hardware unit for testing four channels of the Wheel Drive for specific requirement of ISRO, Thiruvananthapuram. The integrated hardware caters to the analog, digital, frequency and other channel requirements. The ATE software provides real time plots of wheel speed, wheel current, torque and other test requirements as mentioned in the evaluation test plan.


*Automated Test Equipment for Magnetically Suspended Momentum Wheel Test Station (ATE-MSMW)*

### Echo sounder for kilo class submarines

Echo sounder is a navigational aid used to measure, display and record the Depth Below Keel (DBK) of submarine. The system conforms to the JSS 55555 and MIL STD 461F standards. The transducer assembly is fitted at the external hull of the submarine. Electronic units are placed inside the pressure hull. The system works on the principle of ultrasonic echo sounding. It is having two frequency elements. High Frequency element (210 KHz) is used to measure shallow water depth and Low Frequency element of 12 KHz is used for measuring deeper water depth up to 6000 meters.



*SES Mk1 Outboard Unit*

*SES Mk1 Inboard Unit*

### Portable Autonomous Surface Vessel

C-DAC is developing a battery operated, compact, portable, crew-less Autonomous Surface Vehicle (ASV) which can perform tasks in a variety of cluttered environments without any human intervention. ASVs are used for several defense applications, such as mine countermeasures, anti-submarine and maritime security, among others. ASVs have a key role to play in major scientific research areas – Bathymetric survey, ocean biological phenomena, migration and changes in major ecosystems, ocean activities research, multi-vehicle cooperation (cooperative work among aerial, ground, water surface or underwater vehicles), as experimental platforms for the purpose of testing hull designs, communication and sensor equipment, propulsion and operating systems, as well as control schemes Environmental missions, Environmental monitoring, samplings, and assessment.

### Amplifier for SONAR Application

The Power Amplifier (PA) in an active SONAR system is a vital equipment to amplify the user generated low power SONAR signals. The output of the Power Amplifier is fed to the transducers of the SONAR. The signal is complex in nature and differs in frequency as well as amplitude. At present Power Amplifiers are available up to a maximum power range of 10 kW with conventional devices. The proposed 20 kW Power Amplifier is intended to use in ship based towed array sonar system. The operational frequency range is 1.5 kHz to 3.5 kHz. The output of the power Amplifier is of a pulsed format

### Thermal Conductivity Measurement System

Thermal Conductivity Measurement System (TCMS) is an electronic system to measure the thermal conductivity of solid and liquid specimens. The system functions on 'Transient Hotwire' technology where a copper/platinum wire is used as the primary sensor element for the thermal conductivity measurement. The objective is to develop an electronic system for measuring the thermal conductivity by collecting nano-volt level signals from the hotwire sensor element. Primary application of the product is for the quality evaluation of various types of liquid propellants used by VSSC. The thermal conductivity of liquid propellant is an important parameter to determine its usability as fuel for various stages of the rocket launching.

### TETRA Digital Network

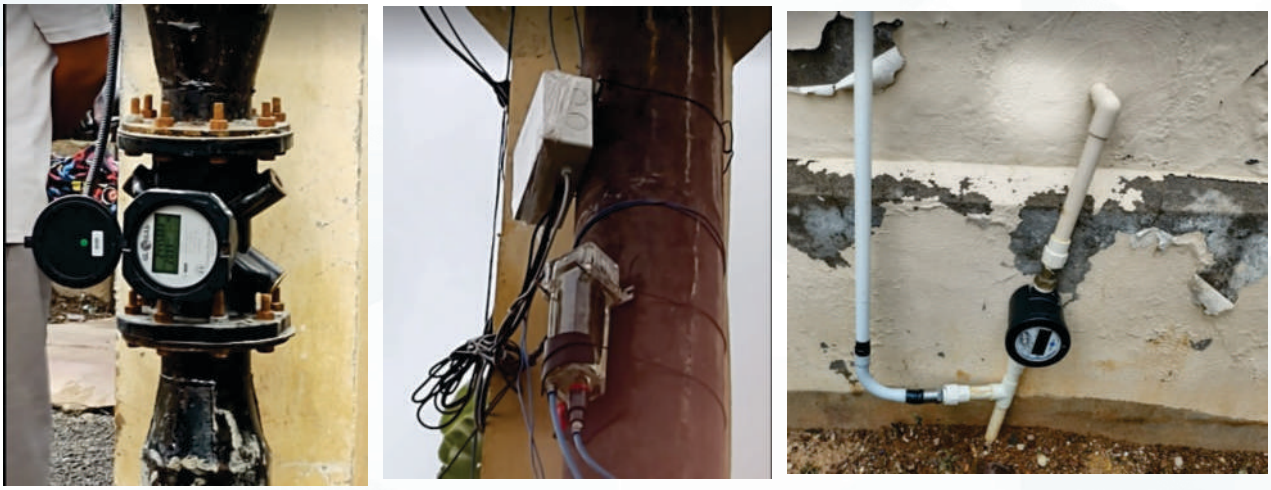
The C-DAC's TETRA Network (CTN) is an indigenously developed Professional Mobile Radio (PMR) communication system based on the TETRA standard. C-DAC's TETRA portfolio include more than 20 products including Base Stations, Mobile Stations, Gateways, Dispatchers, Authentication Centre, Voice Logger, Radio Location Tracker and so on, which provide customers the flexibility to customize their network according to the requirement. The

installation of the TETRA Digital Network based on CTN was carried out at Bhabha Atomic Research Centre (BARC), Mumbai.

## Capacity Building Program

### SMART Water Hackathon

C-DAC is association with The Ministry of Electronics & Information Technology (MeitY) and partnership with National Jal Jeevan Mission (NJJM), launched an ICT Grand Challenge during 2020. C-DAC supported the participants in bringing innovative, modular, and cost-effective IoT solution for monitoring of quantitative and qualitative supply of water at village, semi-rural and semi-urban levels. Start-ups & MSMEs have deployed the IoT pilots in 100 villages covering Maharashtra, Haryana, Andhra Pradesh, Gujrat, Manipur, Rajasthan, Uttar Pradesh, Karnataka and Ladakh. Results of ICT Grand Challenge were announced on March 5, 2022, by Hon'ble Minister Shri. Gajendra Singh Shekhawat, Union Minister of Jal Shakti, Government of India, at Regional conference of States/ UTs on Jal Jeevan Mission & Swachh Bharat Mission Regional (Gramin) at Vidhana Soudha, Bengaluru.



*Deployments inspected at Manchikalapudi Village by the Jury- Source Node and End Tail Node*

# Multilingual Computing and 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 Speech Technologies, Machine Aided Translation Systems, Universal Acceptance and Multilingual Internet, Digital Preservation and Heritage Computing. Details of activities carried out by C-DAC during the year in this thematic area are mentioned below.

## Speech Technologies

### Interactive Voice Response (IVR) service in Bangla and English

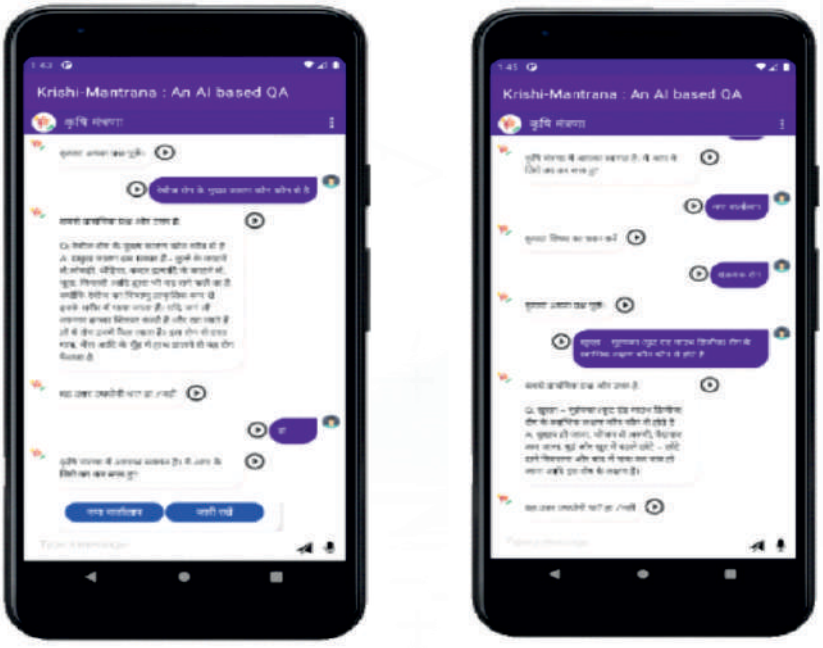
C-DAC has developed Interactive Voice Response (IVR) service in Bangla and English under project titled "IT solution for Sufal Bangla". The system is developed for user feedback collection, Sufal Bangla outlet operating information and agricultural commodity price information dissemination as per options selected by user through DTMF (touch/type based) and Voice inputs. Key Features include 24 hrs automated service over telephone channel, user friendly Input methods via keypad touch/ type or by Bangla language speech, system response in user selected language, direct e-mail notification on every feedback registration, etc.

### Punjabi Text to Speech system

Design and develop text to speech system for Punjabi Language in male and female voice font. C-DAC has collected text covering the various domains and recorded in professional male and female voice in studio environment to build speech corpus. HMM and DNN approach have been adapted to build voice font. Voice font is made available in-service form (API, voice font). End users of this system are people with learning disabilities, people wanting to learn a new language or take an online course, Commuters, people wanting to develop their literacy skills.

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

Krishi Mantrana is an AI based system developed for farmers and agripreneurs that provides quick preliminary advices and addresses farmer's common field related queries in real time. It has been developed jointly by C-DAC, Birsa Agricultural University (BAU) Ranchi, Bihar Animal Sciences University (BASU), Patna. The system supports voice-based question answering in Hindi and Bengali languages in dialogue mode. The answers are displayed, as well as, played back in voice for ease of use. The application has been successfully field tested and is in process of being hosted for use by agriculture stakeholders.




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

## Machine Aided Translation Systems

### Machine Translation System for Lok Sabha

A Machine Assisted Translation (MT) system to facilitate translation (text-to-text) from English to Hindi language and vice-versa for the daily proceeding of Lok Sabha which includes the documents of Bulletin Part I, List of Business, etc. The system is also having facility of post editing tools and workflow-based document management system. The outcome of the proposed system is available in the form of a web application as well as web service. The API with ULCA compliance is deployed on the Bhashini platform and also integrated with LPMF. This MT system has been pilot deployed at Lok Sabha Secretariat, New Delhi.

### E-ILMT English to Hindi Machine translation system for Education and Health Domain

Developed and deployed pilot Machine Translation System for Education and Health domain. It was aimed to translate spoken/written in English to Hindi languages using legacy MT systems by C-DAC and IIIT Hyderabad, combined with current state-of-the-art Neural Machine Translation system. The system is for machine translation using hybrid approach (Rule-based as well as Neural Machine Translation System) for English to Hindi translation having major achievements of 50 thousand parallel sentences (25 thousand from each domain for Education and Health) and 30 thousand domain terms. The API of English to Hindi MT is integrated with translation work bench of IIIT Hyderabad.

### Mantra-Rajya Sabha

MANTRA-Rajya Sabha is a MAchiNe assisted Translation Tool to facilitate the translation of documents pertaining to the Upper House of the Parliament of India from English to Hindi. It simulates the Work-Flow adopted by the Translation Section of Rajya Sabha Secretariat. This system effectively translates the daily proceedings of Rajya Sabha documents (Papers to be laid on the Table [PLOT], List of Business [LOB], Bulletin Part-I, Bulletin Part-II, and Synopsis. The system is deployed at Rajya Sabha Secretariat and is being used for translation from English to Hindi documents during the Parliamentary session. A web-based application that provides a Translation facility along with Document Management functionality has also been developed.

### Multi-lingual translation and subtitling for SWAYAM

C-DAC has developed software solution to provide subtitles for SWAYAM platform courses for various domains to empower students and open opportunities to all. This solution can be used to transcribe, translate and subtitle video lectures into eight Indian languages. The software components include building domain specific terminologies, multi-word expressions, automation to combat speech nuances such as pet words, coughing etc. and usage of acceptable and easy to understand translation. Parallel corpus is generated for education domain in various disciplines covering Biochemistry, Chemistry, Commerce, Computer Science, Education, Environmental Science, Food and Nutrition, Interdisciplinary (Sciences), Mathematics, Microbiology, Planning and Architecture, Library and Information Science, Statistics, Law, Management and Music etc., which in-turn is being used to adapt machine translation system for the domain.

### Localization of Government websites

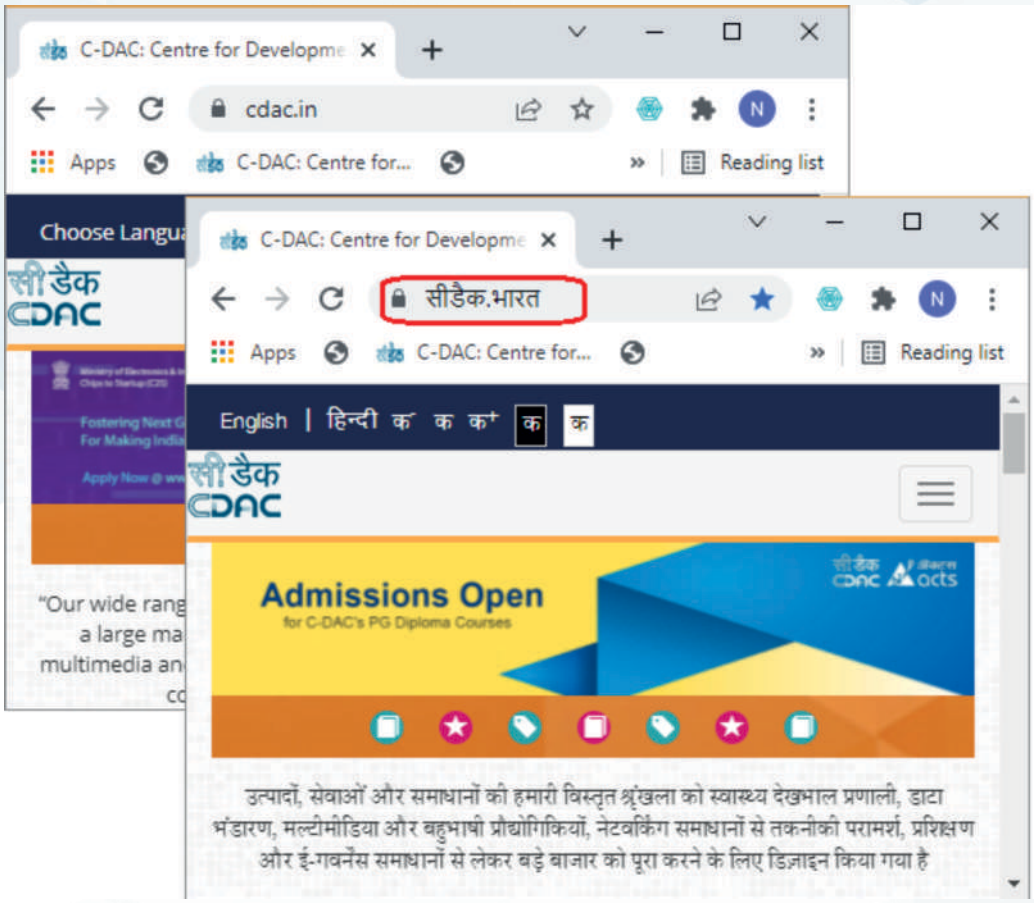
C-DAC has carried out localization and translations for contents of various government departments and ministries of state and centre. This includes MSME, MeitY, Greenie, Govt. of Rajasthan, Govt. of Himachal Pradesh, Govt. of Maharashtra.

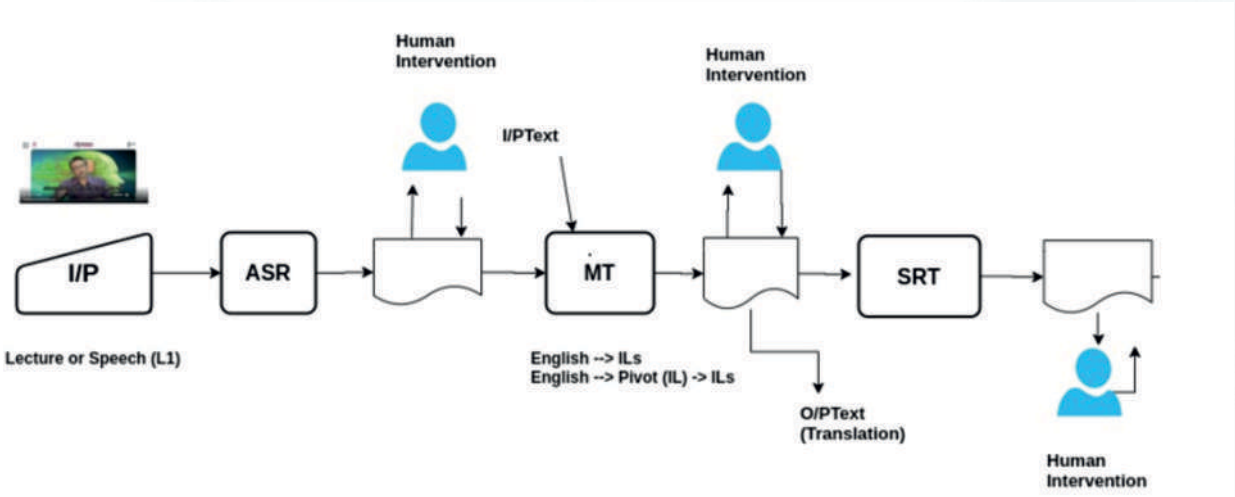
## Universal Acceptance and Multilingual Internet

C-DAC is working on activities related to Universal Acceptance and Multilingual Internet as an extension of the earlier work done in Internationalized Domain Names (IDN) space. MeitY, is the Indian nodal Ministry to Internet Governance and is working on the issues and solutions especially enabling the internet fully ready for Universal Acceptance and Multilingual Internet.

C-DAC has participated in the workshop on "Multilingual Internet" chaired by Shri. Rajeev Chandrasekhar, Hon.

MoS, MeitY and also made cdac.in UA ready. Now, users can navigate to Hindi content directly by typing "सीडैक.भारत".




*UA ready website of C-DAC*

## Digital Preservation and Heritage Computing

### eManuscript

C-DAC has undertaken digitization of 25,000 images of manuscripts available at The Acharya Yogesh Chandra Purakriti Bhavan and developed, deployed an efficient storage, search and retrieval system for old Manuscripts at "The Acharya Yogesh Chandra Purakriti Bhavan (Bankura District Museum), Bishnupur, under Directorate of Archaeology and Museums, Ministry of Information and Culture, Government of West Bengal. Key features of the system includes multiple user access, accessibility and also ensuring that the original manuscripts are untouched. The system is accessible by general public, enthusiast, research scholars, etc. The solution has been deployed at the Acharya Yogesh Chandra Purakriti Bhavan (Bankura District Museum), West Bengal in September, 2021.

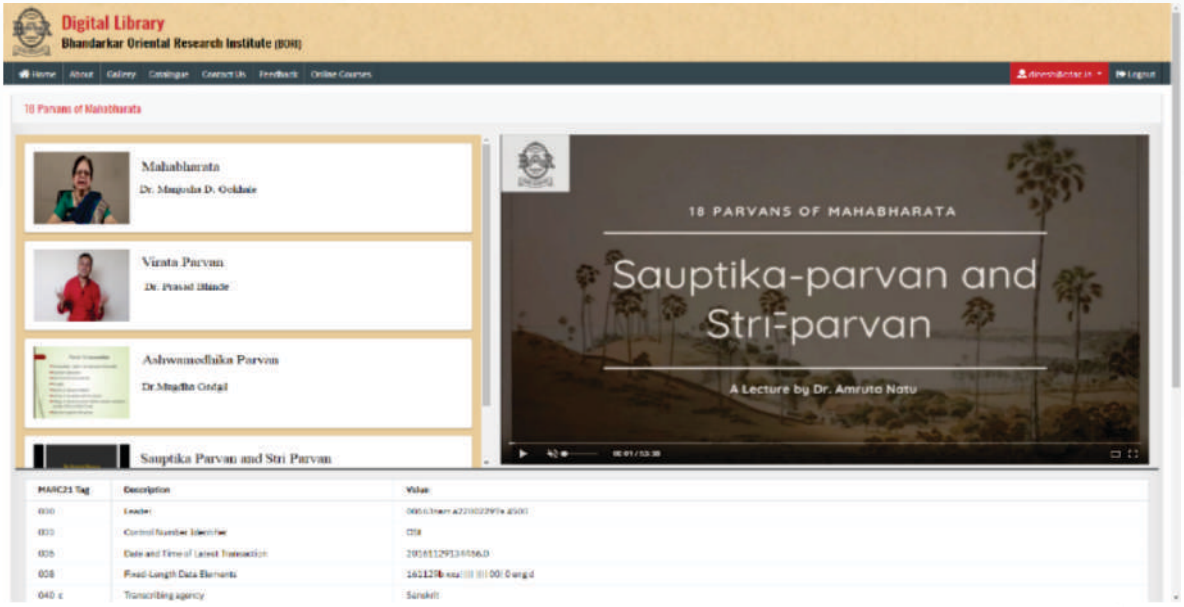
## Intelligent and Interactive Museum

An interactive and intelligent museum is implemented to determine the attention analysis based on the analysis of the time series generated through various parameters such as eye ball tracker, face and speech recognition of the visitor. Key features of the solution include face grabbing and speech recognition engine at the entry gate, transmitting data from entry gate to the exhibit, face recognition unit at the exhibit room, eye tracking and attention analysis of visitors at the exhibit room and facial expression analysis to capture intensity of interest for the particular exhibit, commentary of the exhibit at the preferred language of the visitor at his/her mobile. The solution deployed at Science City Kolkata in December, 2021.


*Visitor in front of Exhibit I with apparatus*

## Digital Library

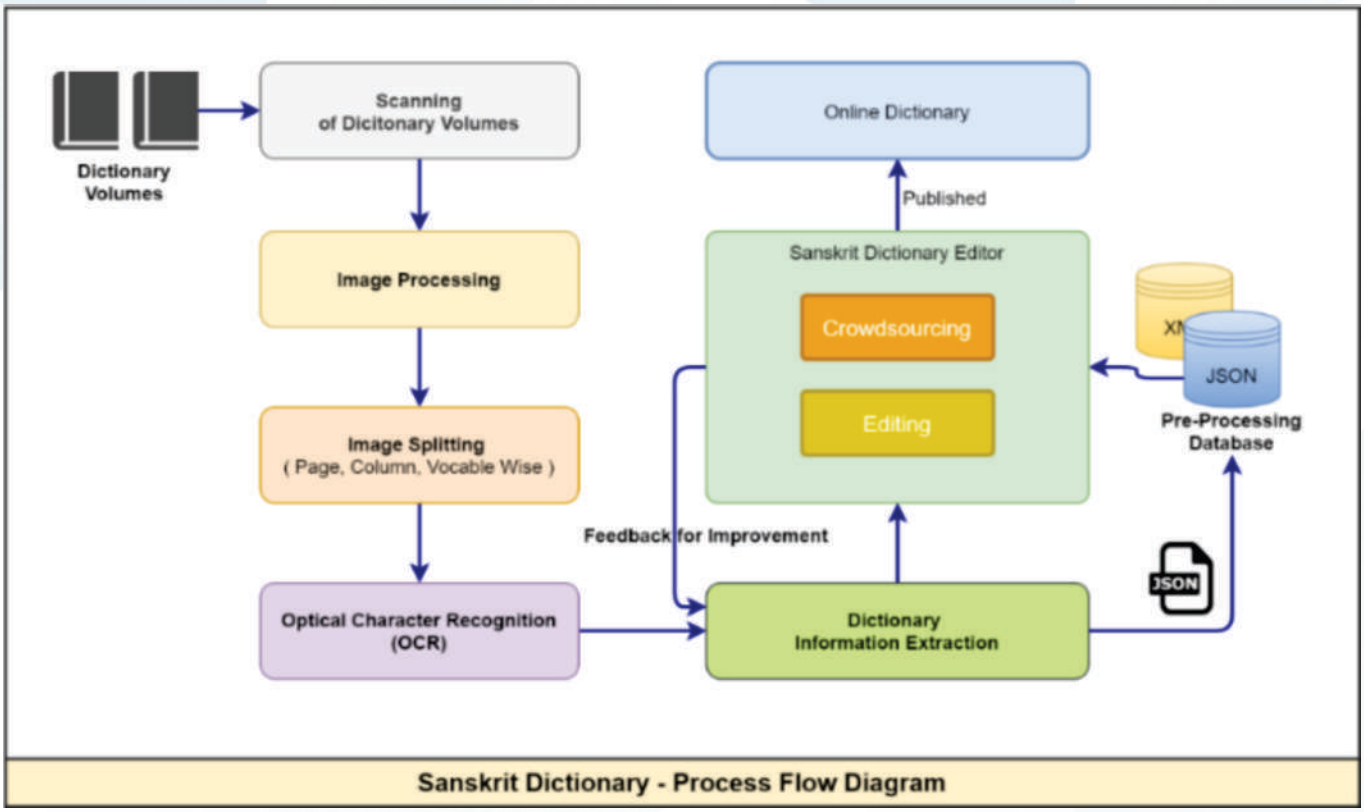
Online platform for delivering courses on Orientology and Indian Heritage has been developed as a part of the Digital Library of The Bhandarkar Oriental Research Institute (BORI), Pune. This has been established using DIGITĀLAYA, an e-Library and Archival System.




*Website of BORI Digital Library*

### Web Portal for Encyclopaedic Sanskrit Dictionary

C-DAC in collaboration with The Deccan College Post-graduate and Research Institute, Pune is working on digital preservation and the development of online portal for Encyclopaedic Sanskrit Dictionary. This is an initiative by Department of Science & technology (DST) under Science and Heritage Research Initiative (SHRI). This solution involves scanning of the existing Sanskrit dictionary volumes, pre-processing and optical character recognition (OCR), building rules for extraction of complex information from the images, correction of the extracted information. Finally, the solution provides vocable information database, new articles for uploading data to the online Sanskrit dictionary portal.




*Sanskrit Dictionary – Process flow diagram*

### Framework for rapid Digitization of Lok Sabha Debates

C-DAC has developed a framework and necessary technology for creating an environment to facilitate rapid digitization for 1st to 10th Lok Sabha debates. It uses image processing and machine learning techniques to provide smart features including layout analysis, automatic Region of Interest detection, dynamic indexing, highlighting of the title, member/ministry name, text extraction and auto-fill facility etc. Apart from this, general features for progress monitoring, two level verification, export, and dashboards have also been made available. This software solution has been developed, deployed and currently being used by Parliament Digital Library.

# Cyber Security and Cyber Forensics

C-DAC is focused and proceeding towards enhancing the cyber security posture of the Nation in a well-rounded fashion as per the vision of Government of India. C-DAC has added to the arsenal of Cyber Security and Cyber Forensics through its R&D this year as well, addressing various challenges in the areas of Identity management, Proactive threat analysis, Mobile security, Cyber forensics, Blockchain Technologies, Post Quantum Cryptography, Asset management, DNS Health and Embedded Security. Also supported with Skill Development, Training and Out Reach in this crucial area through Capacity Building and Awareness programs. Some of the significant achievements covering solutions, products, tools and services offered under this thematic area during the year are listed below:

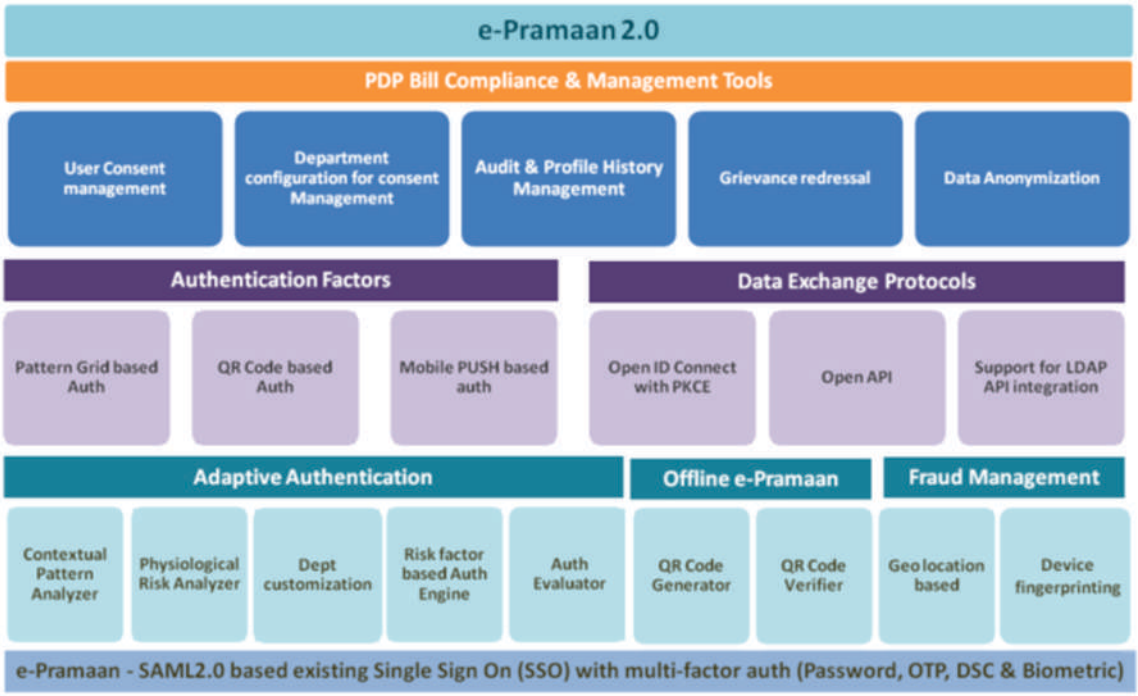
## Identity Access Management and PKI

### e-Hastakshar

C-DAC through its e-Hastakshar, an online digital signing facility, enables citizens with valid Aadhaar ID and registered mobile number to carryout digital signing of their documents on-line, in a legally acceptable form, by enabling trusted method of signing and authentication of the users. C-DAC carried out integration with various Central, State Government Union territories for leveraging e-Sign service at production level and more than 4 Cr. 85 Lakh e-Hastakshars have been issued from July 2016 to Jan 2022. More than 115 agencies are currently leveraging the facility of eSign 2.1.

### e-Pramaan 2.0 – A National e-Authentication Service along with Aadhaar

e-Pramaan is an unique, nationwide whole-of-government initiative for enabling Single Sign On (SSO) and e-Authentication for users of various government sectors, with enhanced authentication features like, "Pattern based Grid authentication", "QR code-based login", "Mobile Push services", "Pattern based Grid authentication", "QR code-based login and Mobile Push services", "User consent management, complying to Data Protection Bill" etc. It provides additional security through various fraud management and adaptive authentication techniques. Also provides a version of e-Pramaan that can be used offline in the absence of internet.




*e-Pramaan 2.0 Feature Stack*

### ASAAUA (C-DAC Aadhaar Services)

C-DAC is empanelled with UIDAI as Authentication Service Agency (ASA), e-KYC Service Agency (KSA) and Authentication User Agency (AUA) for providing Aadhaar based authentication and e-KYC Services. C-DAC is connected with UIDAI's Central Identities Data Repository (CIDR) through dedicated network line for providing secure and prompt authentication services.

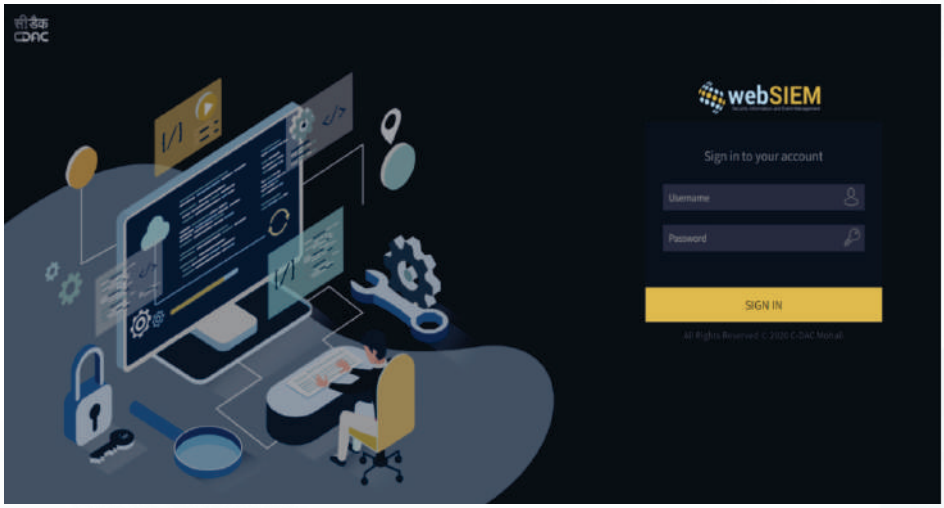
### VKYC RA Software Suite

A "Video Know Your Customer"(VKYC) software Suite is developed and deployed at BEL Software Technology Centre (BSTC), Bengaluru. The KYC solution is fully paperless and online, supporting live streaming, with add-on functionalities like Optical Character Recognition (OCR), Speech-to-text, face recognition etc. Optional cloud service is also available. VKYC comprises of a Central Coordinating Server and a Streaming Server with client applications developed for Android, Web and iOS Systems.

## Proactive Threat Analysis

### Web Security Information and Event Management solution (webSIEM)

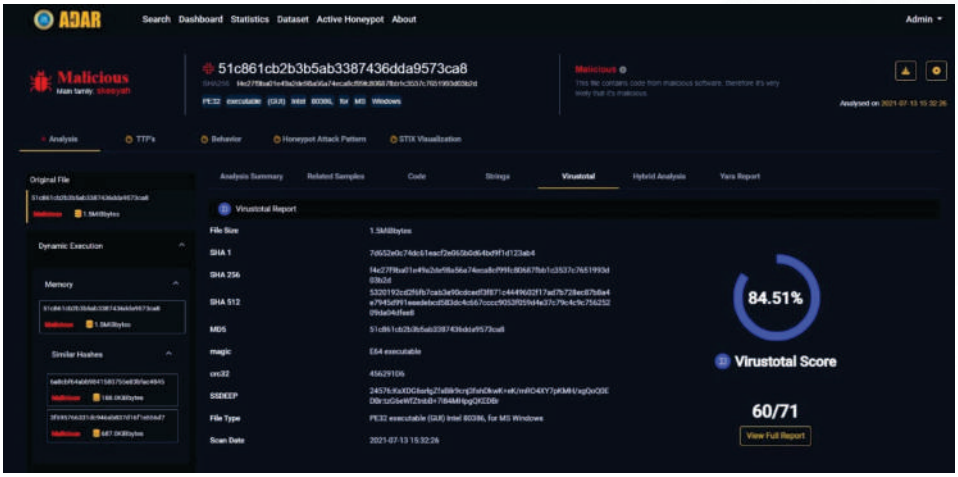
webSIEM uses advanced analytics to find complex threats with minimal noise and also provides incident response frameworks that enable it to automate remediation actions on threats. Threat hunters find threats hiding in data, investigate and drill down deeper into alerts/ events using webSIEM. It ingests logs up to hundreds of gigabytes per day, with long-term data retention. The solution is operational at Indian Oil Corporation Ltd. & HARTRON (DITECH, Haryana).




*WebSIEM Application*

### C-DAC Attack Dataset and Analysis Repository (C-ADAR)

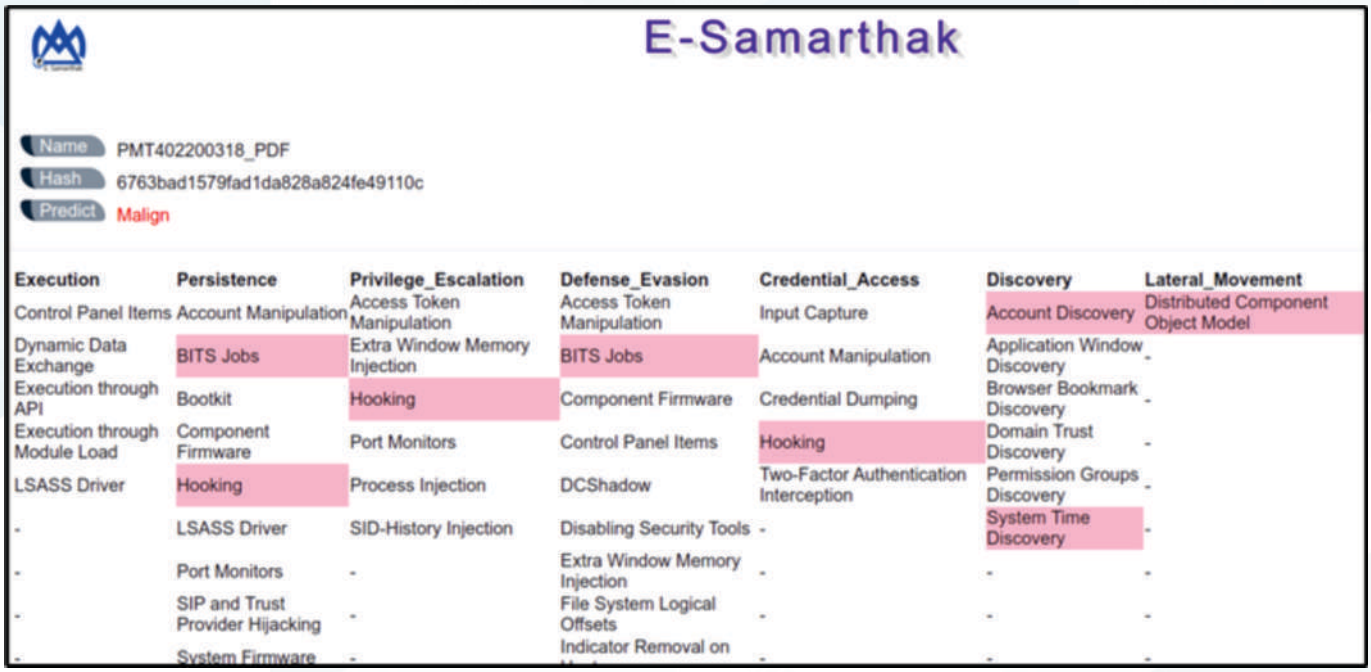
C-ADAR is a complete solution for malware detection, suspicious URL detection and for generation of labelled datasets aiding security analysts, academicians, researchers and government agencies. It has a large knowledge base of labelled and categorized datasets of Malware families and their classifications, Suspicious URLs, API call sequences, Behaviour Reports, Malicious Bytecodes, Opcodes sequences, Malware Image-datasets, exploit codes, Network traffic, Feature Vectors etc., It supports complete threat analysis under one solution for Windows, Linux, IoT binaries, Portable executables, Executable and Link Formats (ELFs) etc. C-ADAR is supporting free registration for researchers, academicians and scientists and can also be extended for use for public purposes.




*C-ADAR Dashboard*

### E-Samarthak

Modern Cyber Security threats such as Ransomware, Advanced Persistent Threats (APTs), Botnets and other Malware variants are categorized under Multistage attacks. E-Samarthak leverages machine learning models and The Adversarial Tactics, Techniques, and Common Knowledge (MITRE ATT&CK) Framework for detecting and predicting multistage attacks. Machine Learning (ML) models are trained on best features and datasets in-line with adversary techniques and provide comprehensive insight for end-to-end attack.

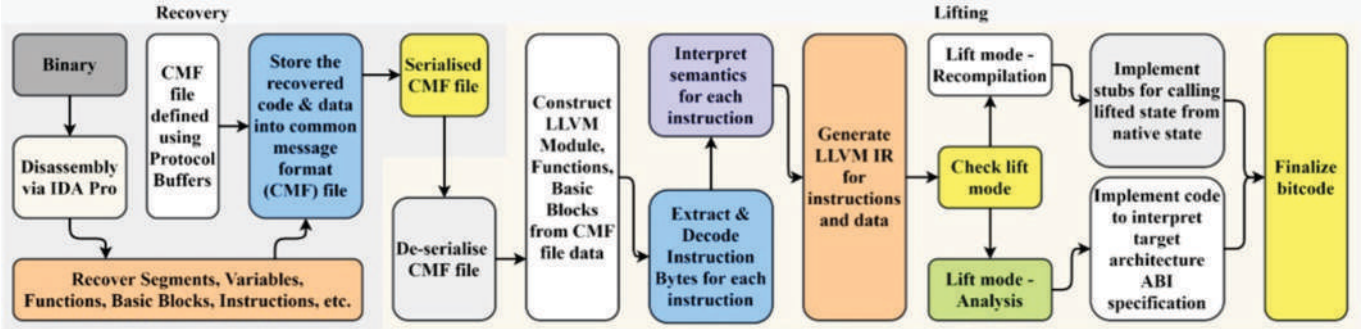



| Execution | Persistence | Privilege_Escalation | Defense_Evasion | Credential_Access | Discovery | Lateral_Movement |
|---|---|---|---|---|---|---|
| Control Panel Items | Account Manipulation | Access Token Manipulation | Access Token Manipulation | Input Capture | Account Discovery | Distributed Component Object Model |
| Dynamic Data Exchange | BITS Jobs | Extra Window Memory Injection | BITS Jobs | Account Manipulation | Application Window Discovery | - |
| Execution through API | Bootkit | Hooking | Component Firmware | Credential Dumping | Browser Bookmark Discovery | - |
| Execution through Module Load | Component Firmware | Port Monitors | Control Panel Items | Hooking | Domain Trust Discovery | - |
| LSASS Driver | Hooking | Process Injection | DCShadow | Two-Factor Authentication Interception | Permission Groups Discovery | - |
| - | LSASS Driver | SID-History Injection | Disabling Security Tools | - | System Time Discovery | - |
| - | Port Monitors | - | Extra Window Memory Injection | - | - | - |
| - | SIP and Trust Provider Hijacking | - | File System Logical Offsets | - | - | - |
| - | System Firmware | - | Indicator Removal on | - | - | - |

*E-Samarthak Application Dashboard*

### Tool For Enabling Binary Program Analysis

C-DAC developed translation tool for converting assembly code to LLVM (open-source compiler infrastructure for lifelong program analysis) IR (Intermediate Representation) for MIPS architecture. Translation tool is developed for MIPS 32-bit Release 2 version 1 ISA. This tool supports researchers to carry out security analysis of binary programs.

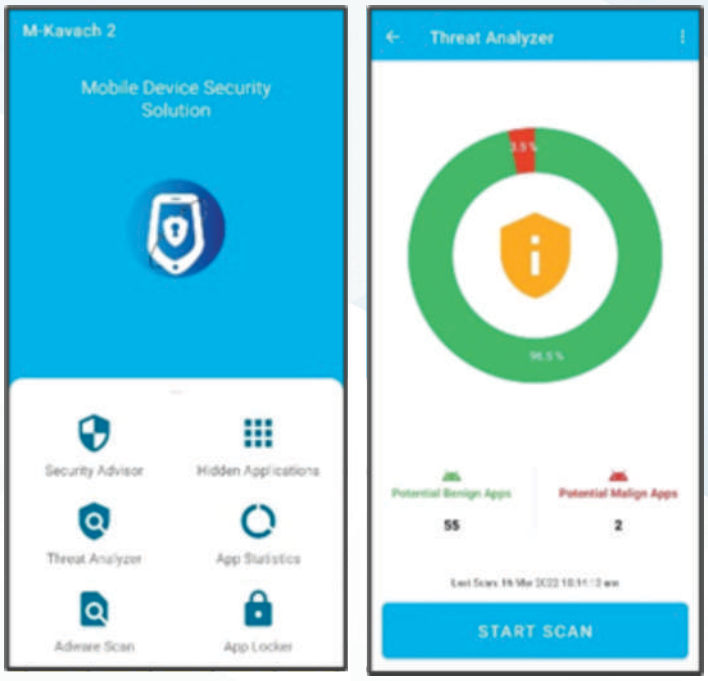



*Binary Program Analysis*

## Mobile Security

### M-Kavach 2

M-Kavach 2 is a comprehensive mobile device security solution with an emphasis on protecting mobile device resources against various emerging attacks. It helps in the detection of hidden and banned apps installed on the device, adware, misconfiguration of the user's device w.r.t Wi-Fi, developer options, hotspot, installation from unknown sources, Bluetooth etc. It also categorizes the potential benign and malign apps which are available in the user's device based on a lightweight Machine Learning (ML) model. M-Kavach 2 is available for download from Google Play Store and Mobile Seva Appstore.




*M-Kavach 2 Mobile Security Solution*

## Cyber Forensics

### PhotoExaminer

PhotoExaminer is useful for classifying, enhancing, analysing and generating the reports of image and video evidences. It is deployed at Cyber Cell in the state of Kerala.

### Advik Web

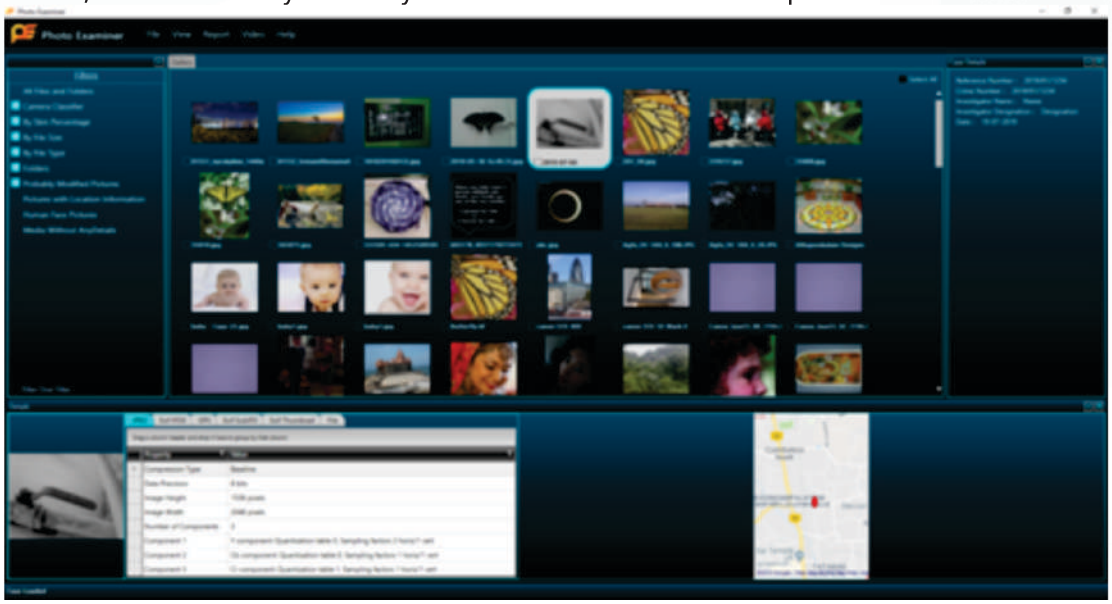
Advik Web is a Call Detail Record (CDR) Analyzer tool for Law Enforcement Agencies. It is a Multi-Tenant Capable system supporting Link Analysis, Timeline Analysis, Geo Analysis, SDR/Cell_Id Integration, etc.

### Web Investigator

Web Investigator is an Internet Forensics Tool for acquiring and analysing Internet usage artefacts supporting Chrome, Opera, Firefox, Safari, IE and Edge Web Browsers.

### Forensics Tools for Apple phone devices and Tablets

iPhone Imager is a forensic imaging tool for iOS devices. iDevice Decryptor, is an iTunes Backup password breaking tool. MobileCheck, is a data recovery and analysis tools for iOS and other smart phones.



*hotoExaminer - Cyber Forensic Application*

### eGlancer- Digital Forensic Kiosk

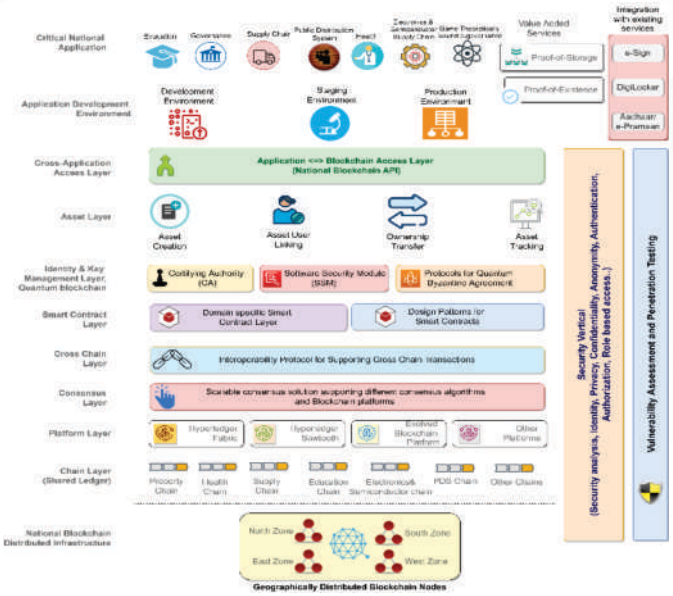
eGlancer, is a stand-alone digital forensic kiosk useful for quick preview and acquisition of electronic gadgets like Smart Phones, SIM Cards, Hard Disks and Pen Drives. Kiosks can be stationed at various transit points like Airports, Seaports, Railway Stations & Police Stations. The investigating officer can conduct a quick preview of the contents within a digital gadget and confiscate the device, having found possible traces of evidential information. The easy-to-use interface allows investigators to examine evidences in a short period of time and aids in taking forensics images of suspicious devices for further detailed analysis.

*eGlancer, Digital Forensic Kiosk*

## Blockchain Technologies

### Unified Blockchain Framework

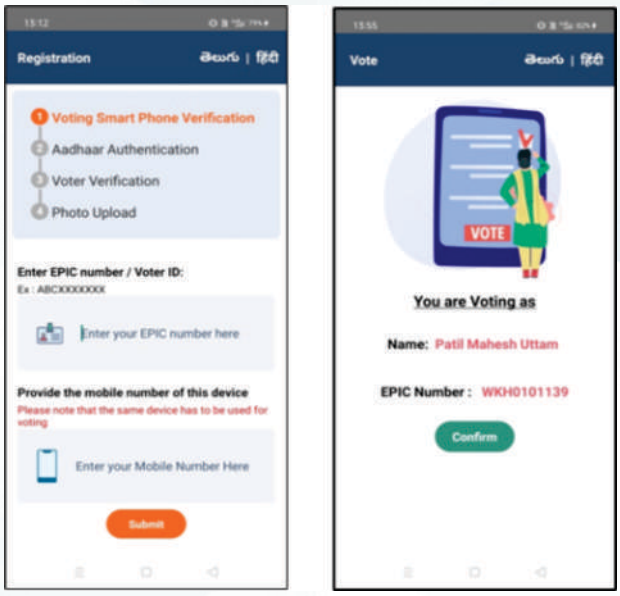
C-DAC is working towards the Design and Development of a Unified Blockchain Framework for offering "National Blockchain Service" and creation of a "Blockchain Ecosystem", with the objectives of architecting an unified Blockchain technology stack for rapid development and deployment of end-to-end, secure, scalable and interoperable Blockchain based applications thus bringing out a Blockchain as a Service (BaaS) Infrastructure. Initiative also includes capacity building programs and collaboration with start-ups. Being implemented in association with NIC, IIT Hyderabad, IIIT Hyderabad, IDRBT Hyderabad and SETS Chennai.




*Unified Blockchain Framework*

### eVoting Solution

C-DAC and Telangana government have implemented Blockchain enabled eVoting solution where in a citizen can cast vote remotely from his/her smart phone. The solution has successfully undergone a dry run which was conducted in Khammam district in Telangana. The solution maintains immutable, de-identified and encrypted votes on the Blockchain network.




*Smart Phone - eVoting Solution Function*

### Domicile Certificate Storage and Verification System

C-DAC has developed a transparent, tamper free, secure blockchain based storage and verification system for Jammu & Kashmir domicile certificates. The system harnesses the power of blockchain technology which makes relevant records immutable and that prevents any kind of fraud with the certificate data. The system is deployed at Jammu & Kashmir, State Data Centre (SDC) and it is in the production environment.

## Critical infrastructure Security

### Asset Management Tool for Securing Critical infrastructure

Asset management tool for Securing Critical infrastructure from cyber-attacks is developed, supporting preparedness and response to serious incidents. It works in hybrid/ non-intrusive mode in real-time, providing asset owners the ability to leverage their existing Industrial Control System (ICS) and network infrastructure and investments to gain operational and cyber security benefits. Provides Key features like continuous monitoring of the Operational Technology (OT) network to detect vulnerabilities, Identification of anomalies in the network, improve compliance to policies etc., thus ensuring reduced down times.

## DNS Health Management

### Online Tool for DNS Health Management

"Online Tool for DNS Health Management" is developed as part of the efforts of Centre of Excellence in DNS Security to measure and understand the health of existing domain names in the DNS ecosystem. This tool provides details such a IPv4 and IPv6 addresses of the domain name and the details of the Name servers that help in resolving the said domain.

## Information Security Services

### Information Security Services (ISS)

C-DAC being a CERT-In empanelled agency offers Information Security Services (ISS) to various state & central

government organizations and private organizations. The offered security services include providing Consultancy for Information Security Management System (ISMS) based on ISO-27001:2013 standards, Cyber Security Audits, Vulnerability Assessment and Penetration Testing (VAPT), Security Audits of Operation Technology (OT), ICS & SCADA, Blockchain and IoT. C-DAC has received 156 work orders under information security services. C-DAC Team also bagged comprehensive Security Review Projects from various organizations.

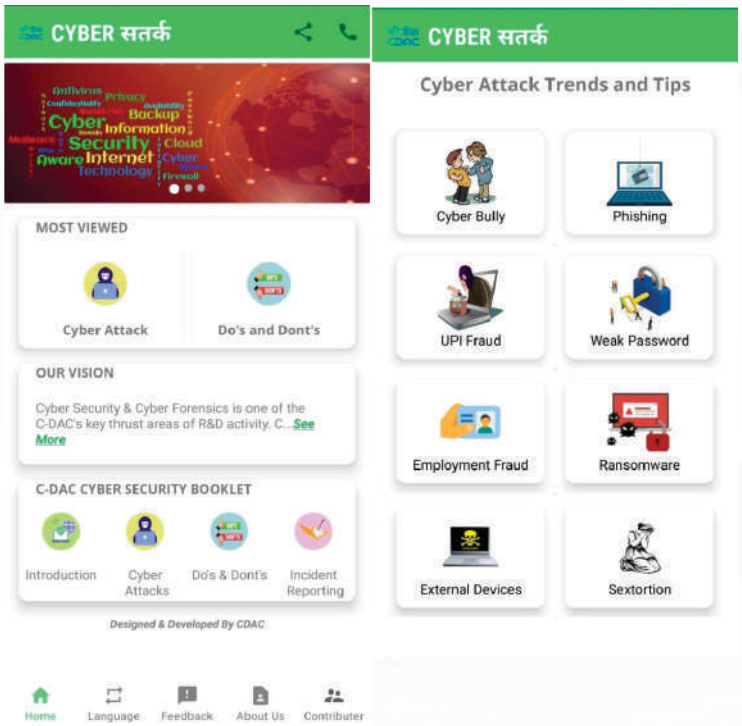
### Setting up of Cyber Forensics Labs

C-DAC is actively contributing towards Setting-up and Operation of Forensics Labs for the Supreme Court, Government of India, Forensic Science Laboratory for Jammu & Kashmir and Cyber Police Station in Kerala. This includes Cyber forensic hardware and software tools Installation, commissioning of the equipment, providing hands on training, operationalization of the facility for a stipulated period of time along with providing maintenance and support.

## Capacity Building and Awareness Creation

### Cyber Satark: Cyber Awareness App

The Cyber Satark App provides a one stop awareness platform for a Cyber Hygiene Practitioner and also builds a full ecosystem to nurture cyber security culture. The application provides an interface for understanding the trending Cyber threats and their precautionary measures. It covers topics on cyberspace, impact of cyber security, different forms of cyber-attacks, their modus operandi, preventive measures (Do's and Don'ts) and steps for cyber-crime reporting. Supports multiple regional languages (Hindi, English, Bangla, Malayalam, Maithili and Marathi) ensuring maximum outreach and cyber-educate the diverse population of India, making them aware of cyber security and the need for cyber hygiene. It is available for download on https://apps.mgov.gov.in/




*Cyber Satark – App*

### Information Security Education and Awareness (ISEA) program

Under Information Security Education and Awareness (ISEA) program, a total of 111 cyber security awareness workshops (Online/ Offline) are organized covering 57602 participants covering Academic, Government users from Ministry/Departments, Police, Defense, Air force, Central Industrial Security Force (CISF), State & Central Government departments, Small and mid-size enterprises (SMEs), Non-IT users, retired persons etc.

# 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), GIS based solutions and Standards Development, etc. 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

### Mobile Seva AppStore

Mobile Seva Appstore is Nation's first indigenous App store and hosted more than 1050 live apps with 8.7 crore downloads of various domains and categories. An extensive testing process is in place to ensure the secure apps are hosted on the platform. Hassle-free upload and download of Apps are supported and ensure verified and digitally signed APK files are uploaded on the AppStore. The platform involves a full digitization process from App upload to testing and sharing of the testing report with the App developers.

### Mobile Seva Phase III

Mobile Seva is an integrated whole-of-government platform for all Government departments and agencies in the country to deliver public services to citizens and businesses over mobile devices. This platform offers features like geo-fencing digital broadcast, secure chat App, m-Gov App container, and Mobile App testing framework, and more than 4192 departments are utilizing the services of this platform.

### Aadhaar Authentication and e-KYC Platform

Aadhaar Authentication and the e-KYC platform provided to IOCL were launched as part of the Ujjawala Yojana 2.0 in August 2021. More than 1.8 crores Authentication/e-KYC are performed using this platform deployed at IOCL Data Center. As part of the overall solution, Aadhaar Data Vault is also provided that is used to secure Aadhaar numbers, and around 24 crore Aadhaar numbers of LPG beneficiaries are stored securely in the Aadhaar Data Vault.

Centre for e-Governance (CeG), Karnataka also has an instance of this solution to cater to the need for Aadhaar authentication and e-KYC to its residents availing beneficiary schemes in the Karnataka state. Around 24 crores of Authentication/e-KYC and 5 crore Aadhaar number tokenization transactions have been performed by CeG using this platform which is deployed at the State Data Centre of CeG.

## e-Governance Application and Services

### Implementation of J&K SAKSHAM Scheme

Jammu & Kashmir's (J&K) e-service platform enables all government services accessible to the J&K citizens through common service delivery outlets and ensures efficiency, transparency & reliability of such services at affordable costs to realize the basic needs of the common man. Special Assistance Scheme for Covid Mortalities (SASCM/SAKSHAM) was launched by the J&K Government to facilitate direct benefit transfer to Covid victims. A total of 60347 beneficiaries are registered through this platform in the various Social Assistance Scheme of J&K in the year 2021-22. Direct Benefit Transfer (DBT) of over 7, 00, 000 cases have been achieved through the developed services of the Integrated Social Security Scheme and National Benefit Schemes from the Social Welfare Department, J&K. The platform also received SKOCH Award in the e-Governance Category for Online Domicile Issuance.

### Online Management, Monitoring & Accounting System

Online Management, Monitoring & Accounting System is complete end-to-end online management solution for J&K Public Works Department (JKPWD). The solution deployed at State Data Centre Jammu was launched in April 2021 and atomizes 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.

### Online MSIPS (e-MSIPS)

The electronic MSIPS (e-MSIPS) application system enables online submission and scrutiny of applications submitted to the Ministry of Electronics and Information Technology (MeitY) under the Modified Special Incentive Package Scheme (MSIPS) and Electronics Manufacturing Cluster (EMC) schemes. The system facilitates the online submission of applications, online scrutiny, recommendations, disbursement, online communication, and generation of responses to the applicant. Revenue of Rs. 63544 Crore was generated for the Government by 262 projects initiated through this platform.

### Solution for Medicinal and Aromatic Plants (MAP)

The mobile and web-based solution is single window access to all the citizen-centric services offered to the medicinal plant cultivators by the Telangana State Medicinal Plants Board. The platform provides Bilingual (Telugu and English) mobile (cross-platform app) and a web-based solution with a single sign-on facility, distinct stakeholder roles, and an elaborate MIS. The solution also sends automated personalized user alerts through multiple communication modes. The major governance/advisory services to MAP stakeholders of Telangana State Medicinal Plants Board are made available to use the features of this solution.


Medicinal and Aromatic Plants Management Portal and App

### Electronic Project Proposal Management System (e-PPMS)

Electronic Project Proposal Management System (e-PPMS) provided to DRDO's 4 research boards and ER&IPR directorate to automate the entire life cycle of project funding from submission to closure including monitoring for various schemes.

### Data Management Software

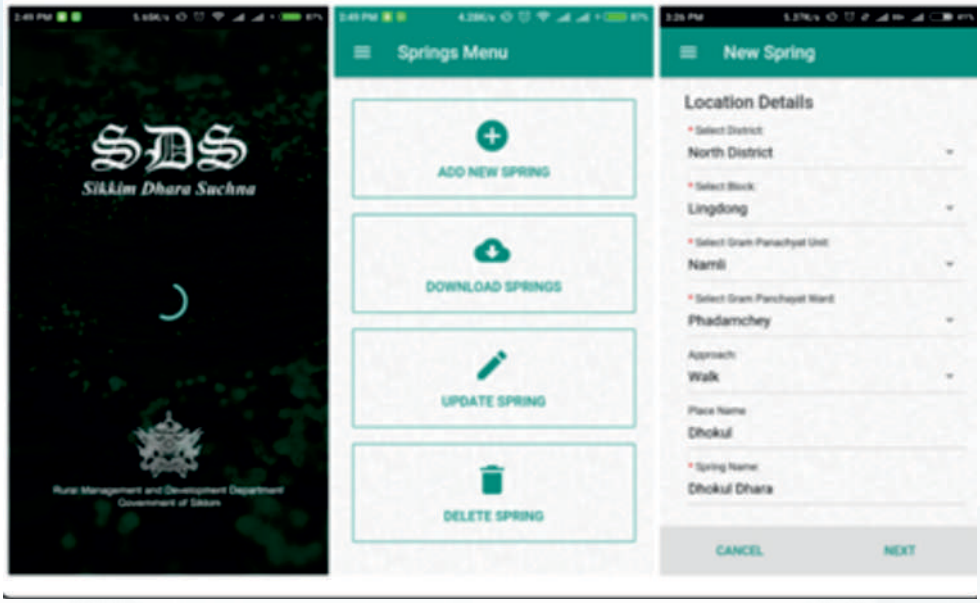
The web-based system for Defense Geoinformatics Research Establishment, DRDO, Chandigarh to receive, archive, and display data for ALCOS. The system facilitates different parameters in station master data, station wise enable/disable sensors for data reception, setting limits to sensor parameters, graphical view of live /archived data & update database from graphs and reports.

### Implementation of RFID for Indian Railways

As part of Phase-II, GS1 standards-based RFID solution was provided to Indian Railways with Enhanced Progressive Web Application (PWA). The solution identifies, reads, parses, and stores EPC data of tags fitted to railway assets such as wagons, locomotives, and coaches, acquiring tag TID data, and train presence detector data through GPIO pins. This solution enables tag operations using a portable RFID reader with features such as XML logging of tag operations, read back operations for all tag operations, tag initialization of existing data fetched from the CRIS server, migrate tag data from older to the latest version, obtain reader's power, battery level, and RSSI values.

## Sikkim Springs Portal and Mobile Application

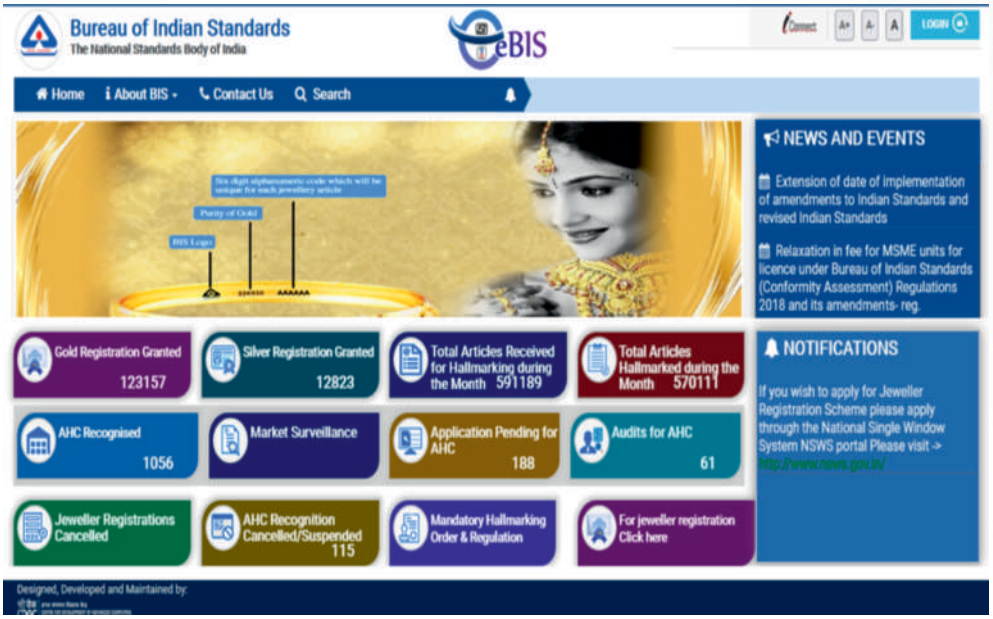
Springs are a natural source of water, especially in hilly terrains, like Sikkim state. Habitations are formed near the location of springs and it is necessary to have an inventory of springs for the management and development of habitations. Sikkim springs portal and 'Sikkim DharaSuchana' mobile application for the Rural Development Department (RDD) of Sikkim provides an inventory of springs for the management and development of habitations. The solution facilitates detailing of the growing inventory of spring resources in Sikkim state along with a mobile application to collect primary data related to spring resources. Map-based presentation of spring atlas, for ease of access and planning of conservation strategies and information related to conservation of springs, lakes, streams, and other water resources are also provided through this platform. More than 2500 springs of Sikkim are mapped through this solution.




*Sikkim DharaSuchana Mobile Application*

## HUID and Surveillance under the e-BIS project

e-BIS is end-to-end e-Governance automation and management system for the Bureau of Indian Standards (BIS). It is a comprehensive integrated IT solution for all the activities of the Bureau including the Hallmark Unique Identification (HUID) system for assigning six-digit alphanumeric code for traceability of the Hallmarked Jewellery. Inspection and authenticity for ISI-marked products can be ensured through mobile app-based surveillance. The solution also facilitates real-time test report generation of tested samples. Around 1, 23,157 gold registration and 1, 28, 23 silver registrations are granted through this solution.




*Hallmark Unique Identification (HUID) system*

## Open-Source Software and ICT for Social Development

### Secure BOSS OS for ICG

C-DAC has customized secure BOSS with a feature set of disk encryption, integrated log management server, policy management server, compliance to cyber audit policy with blocking of external USB storage, Bluetooth, etc. The customized secure BOSS OS is developed for the Indian Coast Guard for internet-facing machines. The BOSS clients are also pre-configured in compliance with cyber audit policy, log and patch management.

### Web Portal for Empowerment of Persons with Disabilities (Divyangjan)

A web portal developed for the Department of Empowerment of Persons with Disabilities (DEPwD), Ministry of Social Justice and Empowerment, Govt. of India to assist Divyangjan in purchasing/fitting aids/appliances (ADIP). This Portal is a single platform and maintains a national-level centralized database of disabled persons and details of aids and assistance devices provided to beneficiaries.

### Knowledge & Resource Centre for Accessibility in ICT (KAI)

KAI is an initiative of the Ministry of Electronics and IT (MeitY), Government of India for the preparation of Standard for Accessibility requirements for ICT products and services and to carry out training and capacity building. Ministry of Electronics and Information Technology (MeitY) & C-DAC have been engaged in formulating ICT Accessibility standards along with STQC & BIS. Accessibility for ICT Products and Services Part-I Requirements (IS 17802 Part 1): 2021 standard has been gazetted and published by BIS in December 2021. The draft Part-II of the standard towards determinant and conformance is prepared. KAI also conducts various awareness, capacity building, and Train-the-Trainer events towards proliferation, adoption, and implementation of the accessibility standards.

रजिस्ट्री सं. डी.एल.- 3304/99 REGD. No. D. L.-3304/99

भारत का राजपत्र
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असाधारण
EXTRAORDINARY
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PART III—Section 4
प्राधिकार से प्रकाशित
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भारतीय मानक ब्यूरो
(उपभोक्ता मामले विभाग)
अधिसूचना
नई दिल्ली, 24 दिसम्बर, 2021

संदर्भ: HQ-PUB013/1/2020-PUB-BIS (278).— भारतीय मानक ब्यूरो नियम, 2018 के नियम 15 के उपनियम (1) के अनुसरण में भारतीय मानक ब्यूरो एतद्द्वारा अधिसूचित करता है की जिन भारतीय मानकों के विवरण इसमें संलग्न अनुसूची के द्वितीय स्तंभ में दिये गये हैं, तीसरे स्तंभ में इंगित तिथि को स्थापित हो गये हैं। चौथे स्तंभ में दिये गये मानकों के विवरण, यदि कोई हो तो वे भी साथ-साथ लागू रहेंगे जब तक वे पाँचवें स्तंभ में इंगित तिथि को वापस लिए जाते हैं।

अनुसूची

| क्रम सं. | स्थापित भारतीय मानकों की संख्या, वर्ष तथा शीर्षक | प्रतिस्थापन तिथि | भारतीय मानकों, यदि वापस लिए जाने हैं, की संख्या, वर्ष तथा शीर्षक | वापस होने की तिथि |
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| (1) | (2) | (3) | (4) | (5) |
| 1 | आई एस 17802 (भाग 1) : 2021 आइसीटी उत्पादों और सेवाओं के लिए अभिगम्यता भाग 1 अपेक्षाएं | 24 दिसम्बर 2021 | लागू नहीं | लागू नहीं |

7568 GI/2021 (1)

*IS 17802 Part 1: 2021 Standard*

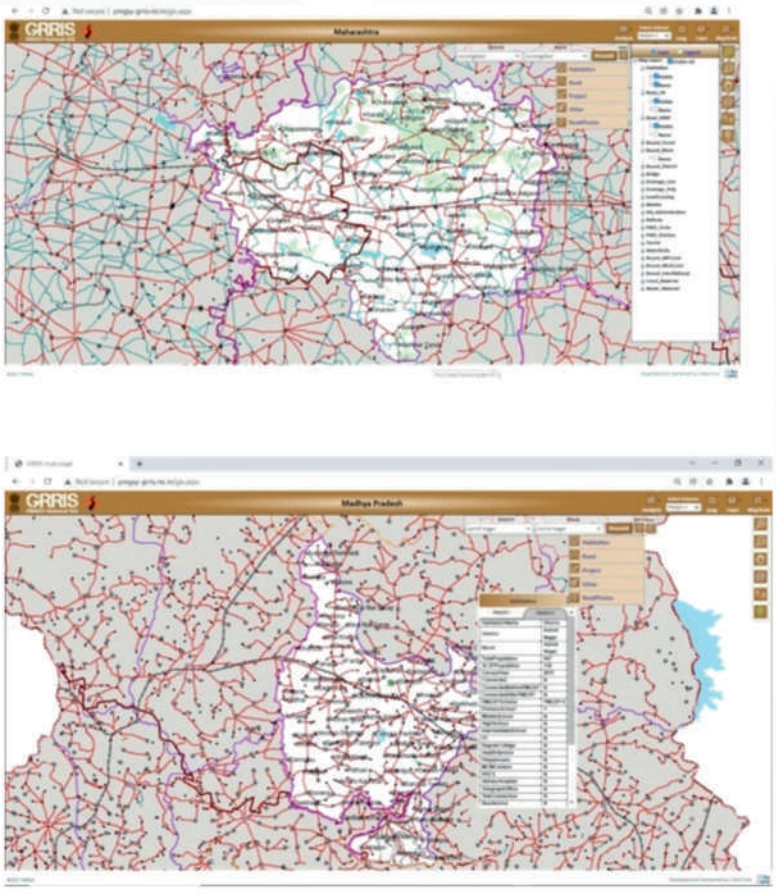
## GIS Based Solutions

### GeoSadak 2

GeoSadak-2 based on FOSS, utilizes fully indigenous GIS data layers & satellite data services (ISRO Bhuvan, OpenStreetMap, etc.), aligned with 'Atmanirbhar Bharat'. GeoSadak-2 collates, manages, and serves geospatial data in real-time. The system is being utilized by all the State Government departments and the Ministry of Rural Development to track the proposals for new roads, up-gradation, monitoring, and management. Around 10760 proposals have been drawn and approved through this solution. Ministry of Rural Development has also released the datasets of this platform under the Government's Open Data License as public goods of national importance. These datasets can be used by various government departments, startups, academia, and students/youth to improve the lives and economy of more than 800 million Indians living in rural India.

### Geospatial Rural Road Information System (GRRIS)

Geospatial Rural Road Information System (GRRIS) is a national level geographical presentation of Pradhan Mantri Gram SadakYojna (PMGSY). The system generates dynamic geospatial outputs using the national level MIS database (OMMAS) and associated geospatial information. GRRIS enables every citizen in the remotest corner of the country to visualize the details of the rural roads constructed/improved/covered under the PMGSY scheme. GRRIS facilitates a view of all road related details like Road Category, Road Ownership, etc. to various stakeholders.




*Geospatial Rural Road Information System*

### Vehicle Tracking for Public Distribution System

Vehicle tracking and fleet management solution for Kerala State Civil Supplies Corporation (SupplyCo) has geo-tagged 14503 locations and 2011 routes with 595 vehicles to monitor the door-to-door delivery of food grains under the Public Distribution System (PDS). The solution helps to monitor & ensure timely delivery of food grains through pre-defined routes to mitigate pilferage, route traceability of transportation of goods between origin and destination locations, and verify for retrospection. The solution also assists in improving the efficacy of fleet operations and logistics activities based on dynamic enrolment, route management, trip scheduling, vehicle utilization analysis, and driver rating.

### Fleet Management System

The fleet management system complaint with AIS-140 standard provides end-to-end management and smooth operations of fleet-based activities and vehicle tracking. The solution facilitates Vehicle Location Tracking Device (VLTD) tagging, device management, live monitoring of fleet based on location, routes, a flexible alert configuration of SoS, over speeding, geofence, ignition, idle, and halt conditions. The solution also provides the facility to determine rash driving, intimations based on SMS, email notifications, route design, optimization, scheduling, crew management, etc. for overall fleet management.


*Fleet Management System*

## Standards Development

### e-Governance Standards & Guidelines

C-DAC is involved with various stakeholders in the formulation of e-Governance standards, guidelines, policies and frameworks to ensure efficient and effective government services. As part of this initiative 15 more Standards/Guidelines/Frameworks for adoption/release & review of existing standards through Working Group, Technical & Advisory Committees meetings were carried out. In addition to this, 30 awareness workshops were conducted during the year 2021 to spread the awareness, capacity building, and promotion and outreach programs for various stakeholders. A one stop portal to get information related to standards development and repository to maintain the developed/approved standards is also being updated on a regular basis.

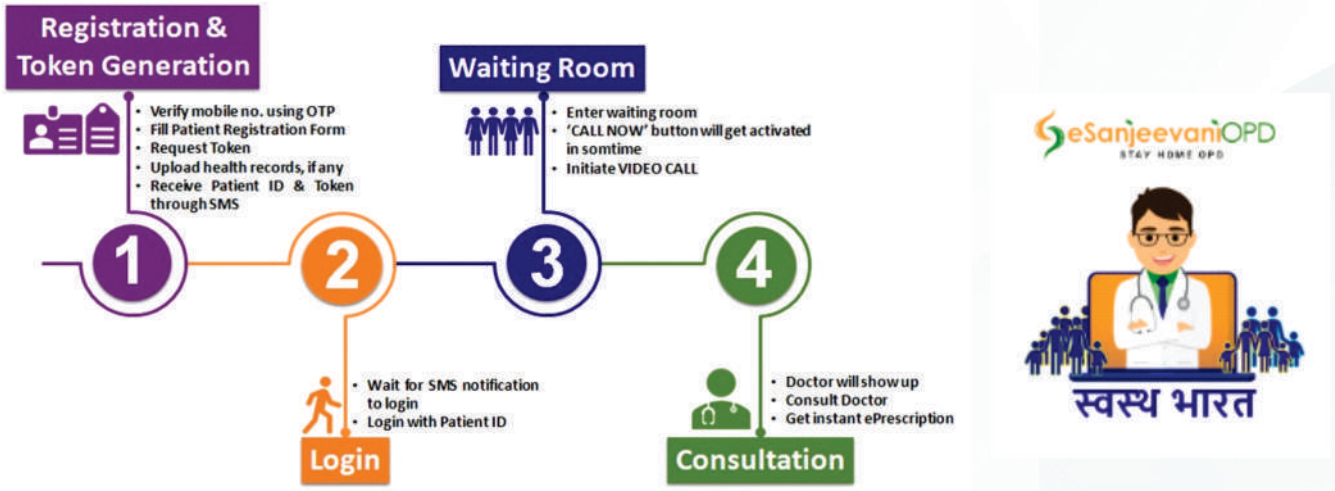
# Health Informatics

Health Informatics comprises 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. CDAC's health informatics solutions and research has contributed immensely to achieve the goals of making affordable and quality healthcare accessible to the people. Various activities carried out by C-DAC during this year in this thematic area are briefly described below.

## National Level Initiatives

### eSanjeevaniOPD (Patient to Doctor Telemedicine)

eSanjeevaniOPD is a patient to doctor tele-consultation system developed for Ministry of Health and Family Welfare (MoHFW). The solution provides teleconsultation services to patients through safe and structured video-based clinical consultations between doctors in a hospital and patients at home. The solution under the heading 'Stay Home OPD' was launched in April, 2021. Around 1072 online OPDs have been set up on eSanjeevaniOPD. Around 29,283 doctors have been registered on this platform with 7.4 million consultations in 35 states.




*eSanjeevaniOPD- Process Flow*

### eSanjeevaniHWC (Doctor to Doctor Telemedicine)

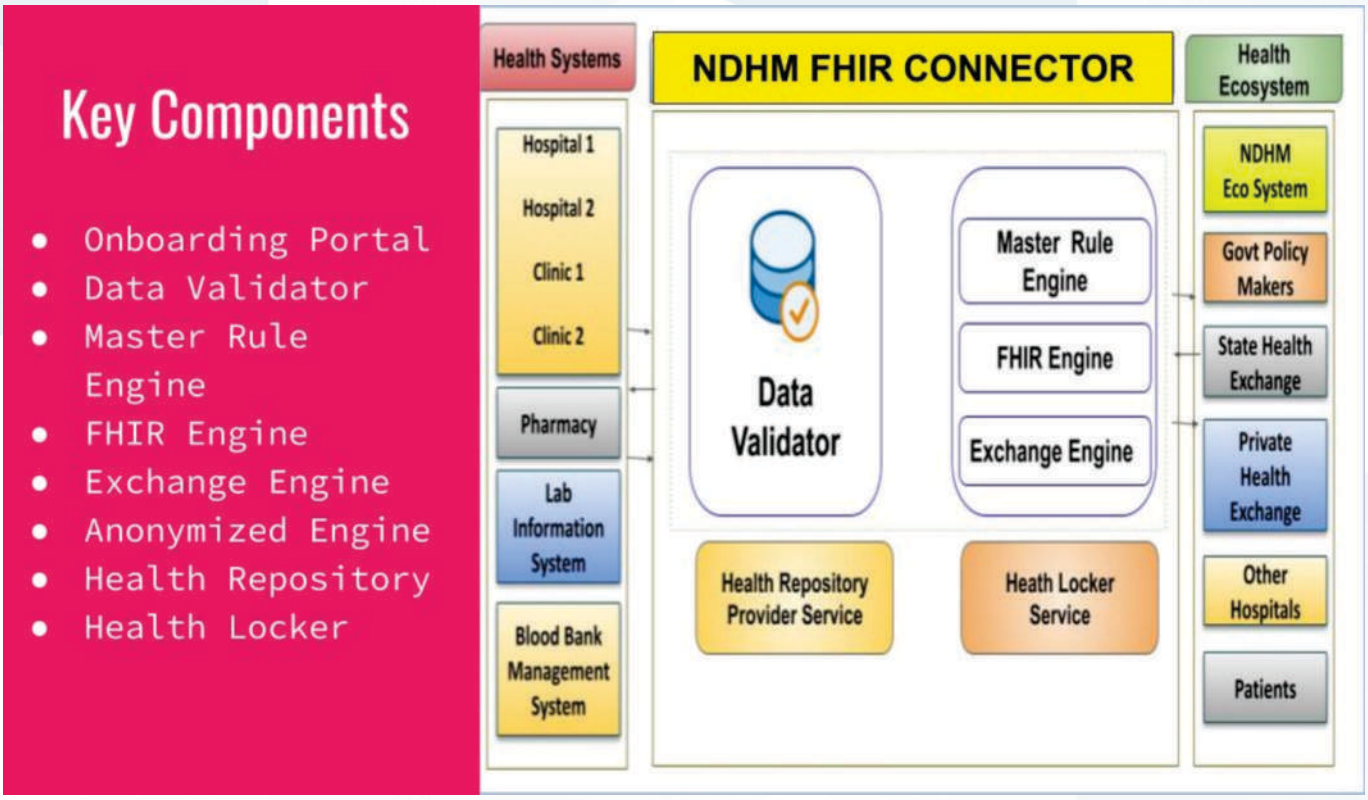
eSanjeevaniHWC is Doctor-to-Doctor telemedicine system under Ayushman Bharat- Health and Wellness centers scheme of the Government of India, to provision specialized health services in rural areas and isolated communities thereby alleviating the rural-urban, digital health divide. It follows 'Hub and Spoke Model' with Health and Wellness Centres (HWCs) at State Level acting as Spokes, aligned to the Hub of Doctors (comprising MBBS/ Specialty /Super-Specialty doctors) at Zonal level. It has been implemented at around 45,114 Spokes, 4070 Hubs and over 91,606 paramedics and doctors have been trained and on boarded till now. eSanjeevani network is operational in 30 States.

### Ayushman Bharat Digital Mission Compliant e-Sushrut

e-Sushrut is a Hospital Management Information System compliant with EHR-2016 standards of Ministry of Health and Family Welfare, Government of India provides a mechanism for digitizing and streamlining the workflow of hospital services. e-Sushrut has been customized as per the functional requirement of Indian Railways Health Facilities and deployed at 715+ Indian Railway Hospitals across India. The solution is also deployed at various AIIMS centres across India viz. Patna, Raipur, Mangalgiri, Bhubaneshwar, Raebareli, Nagpur, Gorakhpur, Bhatinda, Kalyani, Deogarh, Bhopal and Rajkot. Government of Arunachal Pradesh has approved implantation of Sushrut HMIS across

132 Health Institutes and SAIL Bokaro has also approved implementation of e-Sushrut for its General Hospital & 12 associated health facilities.

e-Sushrut application has been made compliant for Ayushman Bharat Digital Mission (ABDM) to generate Health ID, sharing the electronics records to DigiLocker, exchange of care context with ABDM ecosystem. It fetches the patient records from NDHM ecosystem as per the consent of patient and making it available at Doctors Workbench. The solution has been deployed at Railway HMIS, AIIMS Manglagiri, AIIMS Bhopal, AIIMS Gorakhpur, AIIMS Kalyani, AIIMS Rajkot, AIIMS Bhuvneshwar, AIIMS Raibarely, AIIMS Nagpur, AIIMS Patna, AIIMS Deoghar, AIIMS Bhatinda.




*ABDM Compliant e-Sushrut*

### 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 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. More than 2,71,927 patients have already been served through SeHATOPD's that is functional till March 2022. More than 3,741 doctors (AFMS) have been trained and on-boarded through this platform.

### e-Aushadhi (DVDMS)

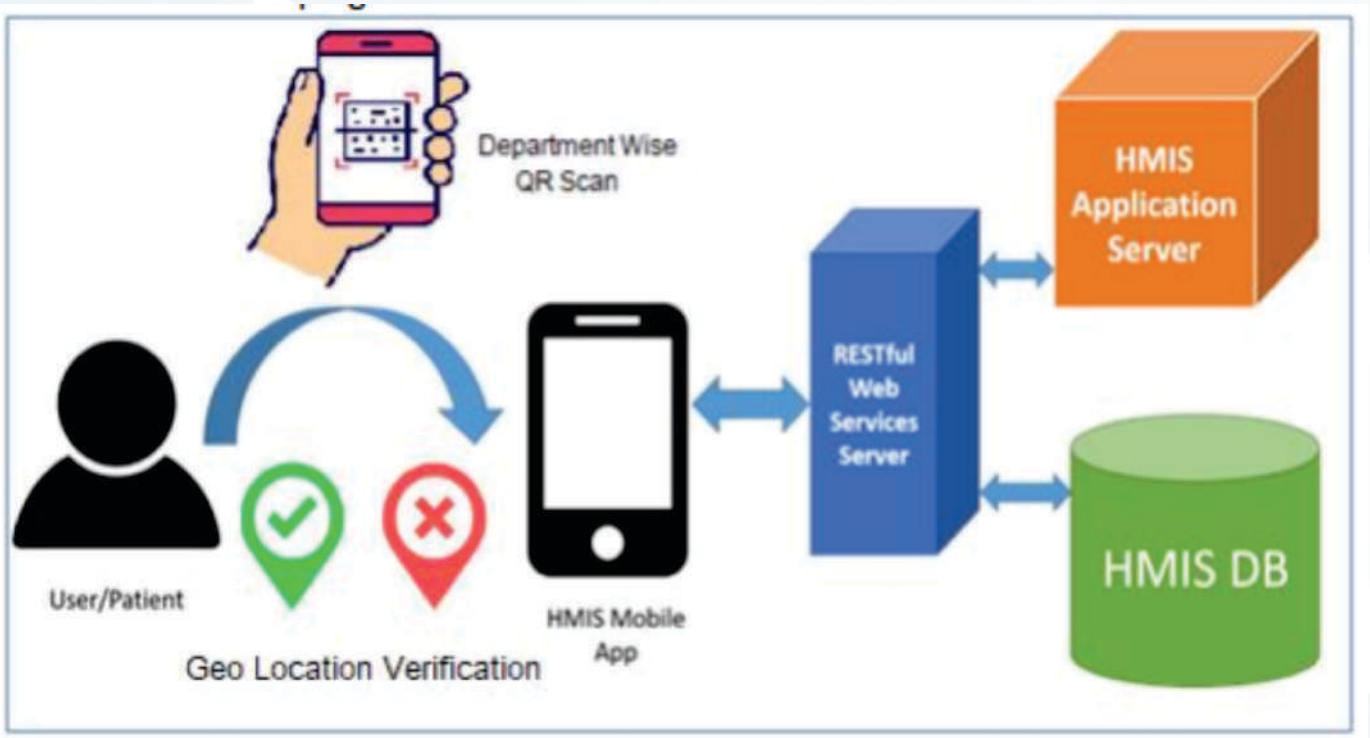
Drugs & Vaccine Distribution and Management System (DVDMS) is a web-based Supply Chain Management System developed by C-DAC that deals in Purchase, Supply, Distribution and Inventory Management of various drugs, sutures, surgical and consumable items by linking various Regional/ District Drug warehouses (DWH), District Hospitals (DH), their sub stores like Community Health Centre (CHC), Primary Health Centre (PHC) and Sub-Centre. The system also has the functionality for distribution of drugs to patients, thus enabling tracking of consumption till last mile. With inclusion of OSMCL Odisha & Lakshadweep e-Aushadhi deployment tally has increased to 29 Instances in India this year covering 22 States, 2 Union Territories, 5 National Program under MoHFW.

## Health Informatics Solutions

### QR Code Based e-Visit Patient System

QR code based e-Visit solution provided to AIIMS, Railways, Government Hospitals helps to avoid long queues,

overcrowding and waiting time at Hospital Counters for registering at Out Patient Departments (OPDs) and clinics. System enables QR code based geo-fencing, digital payment workflow, and state of the art technologies including 5G.




*e-Visit Patient System*

### Mercury™ Nimbus Neo Telemedicine Solution

Mercury™ Nimbus Neo Suite is cloud-enabled EMR/EHR-centric teleconsultation solution & Tele-ICU solution that can scale from clinic to multi-hospital deployment scenarios. The developed solution is highly available, scalable, and secure to doctor to doctor & patient to doctor teleconsultation operations with EHR records management. Solution is enabled for 5G network to offer reliable Telemedicine-related services which is tested on a 5G testbed offered by Centre of Excellence in Wireless Technology (CEWiT).

Mercury™ Telemedicine solution is operational at 06 specialties connecting to 30 district hospitals, and 13 e-ICU locations of Odisha. NTPC Telemedicine Network (Phase-II) was inaugurated on December 13, 2021 connecting 4 specialties with 15 district hospitals across India. Approximately 30,000 patients are benefited using Mercury™ Telemedicine Solution in NTPC and Odisha state.

### Adverse Drug Reactions Monitoring System (ADRMS)

ADRMS is Indigenous solution for Adverse Drug Reactions (ADR) that includes reporting, data mining, analysis for signal detection and risk benefit assessment of the marketed drugs in India. The main feature of the system is enablement of Pharmacovigilance Activities Online – ADR Reporting & Signal Detection, generating drug safety data based on genomic characteristics of Indian population, reporting, data mining, analysis for signal detection, risk assessment of the marketed drugs. Services are hosted at C-DAC Noida data centre.

### SUGAM 2.0

SUGAM enables online submission of applications requesting permissions related to Drugs, Medical Devices, Vaccines, Clinical Trials, Ethics committees, Blood Banks, Blood products, and Cosmetics. The system also builds up the National database of Approved drugs, manufacturers & formulations, retailers & wholesalers in India. The mega portal is being widely used by the pharmaceutical industry. It has ~20492+ registrations of pharmaceutical firms, 34 CDSCO regional offices, ~231721 online application submissions, and 200950+ approvals.

### 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 Odisha, State of Rajasthan and State of Punjab. With these deployments, the e-Upkaran has now been deployed in 11 States.

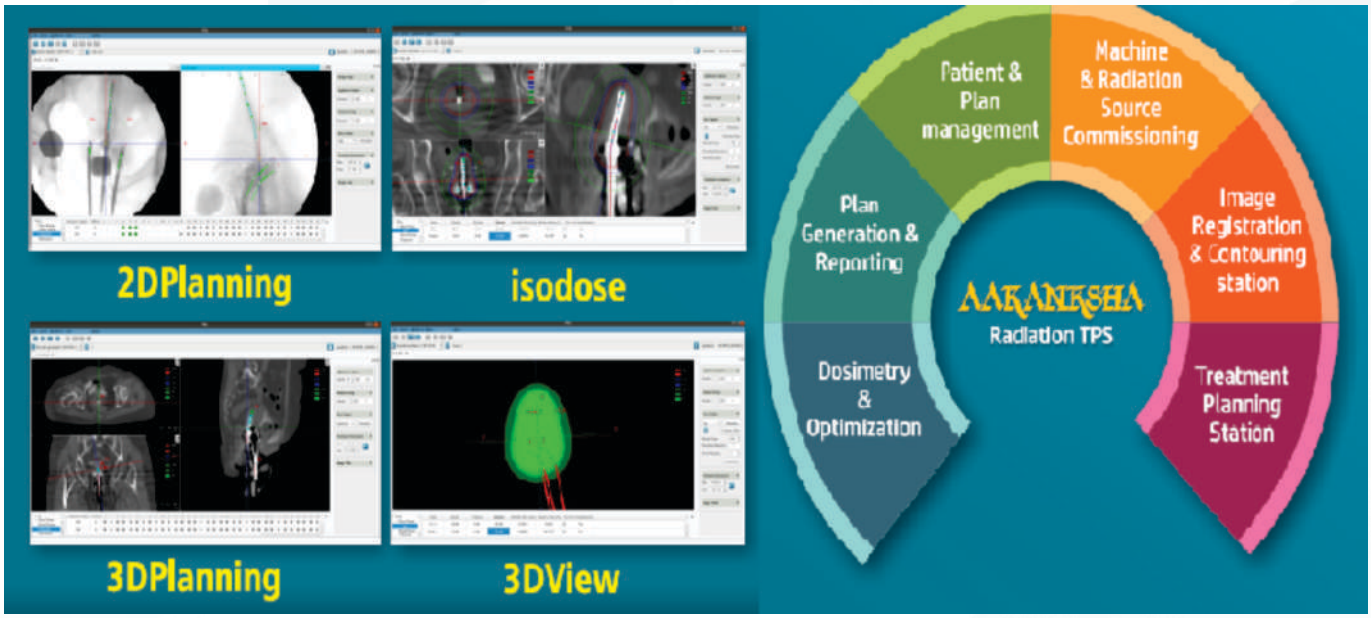
### eBloodServices for IRCS HQ Delhi

The eBloodServices mobile app for Indian Red Cross Society (IRCS), National Head Quarter (NHQ), Blood Bank primarily facilitates in bringing 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 is also enabled with features as Donor Profile, Donor Pledge, Online Camp Request and Thalassemia Request

## Healthcare Solutions

### Radiation Treatment Planning System

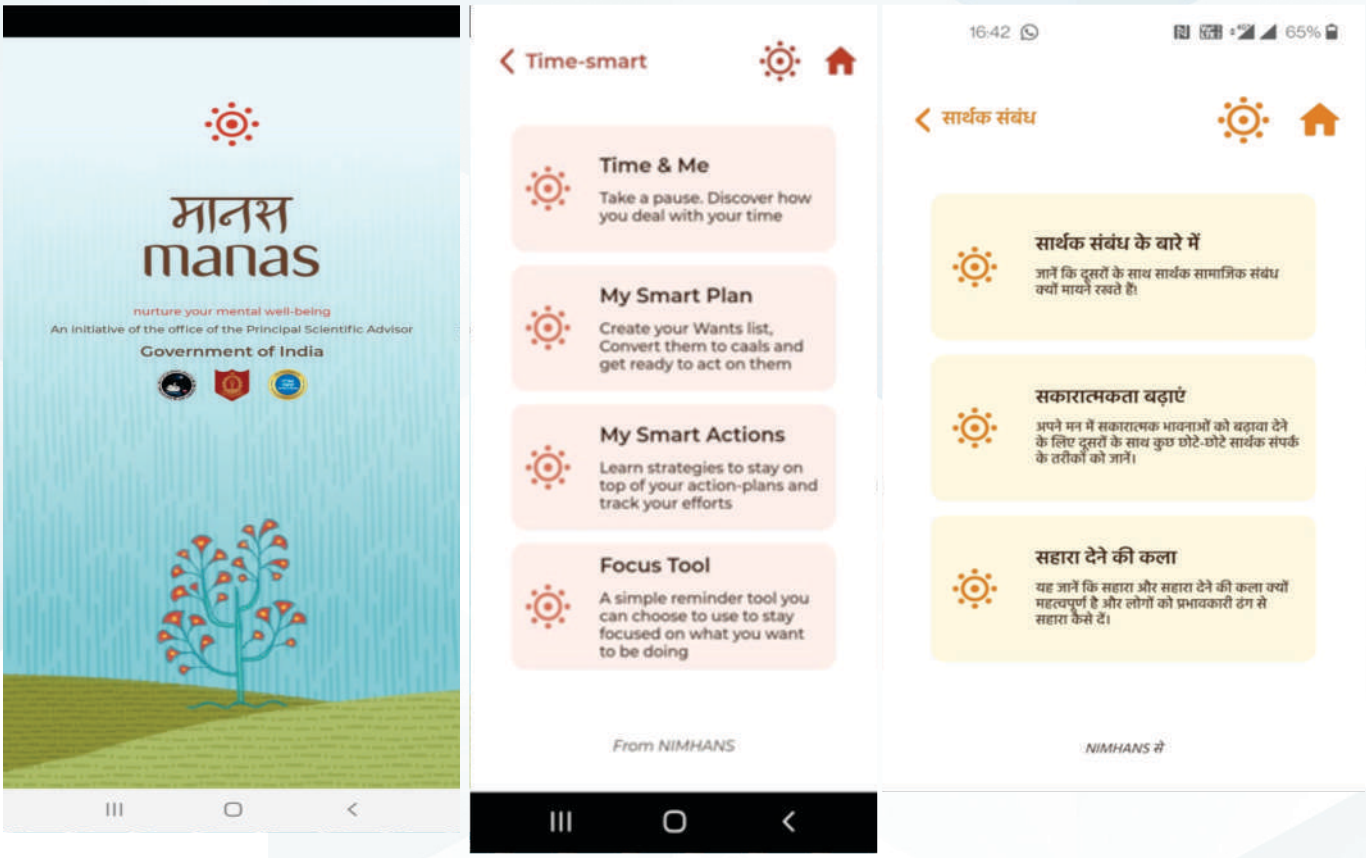
The Radiation Treatment Planning System (TPS) provides radiation experts (oncologists and physicists) a visual tools and controlled workflow to ensure treatment efficacy and patient safety by assisting in planning approach path, radiation level & exposure, etc. The TPS systems are tightly dependent on 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. It is deployed in Tata Memorial Cancer Hospital (TMC), Mumbai.




*Radiation Treatment Planning System*

### MANAS – Phase-I

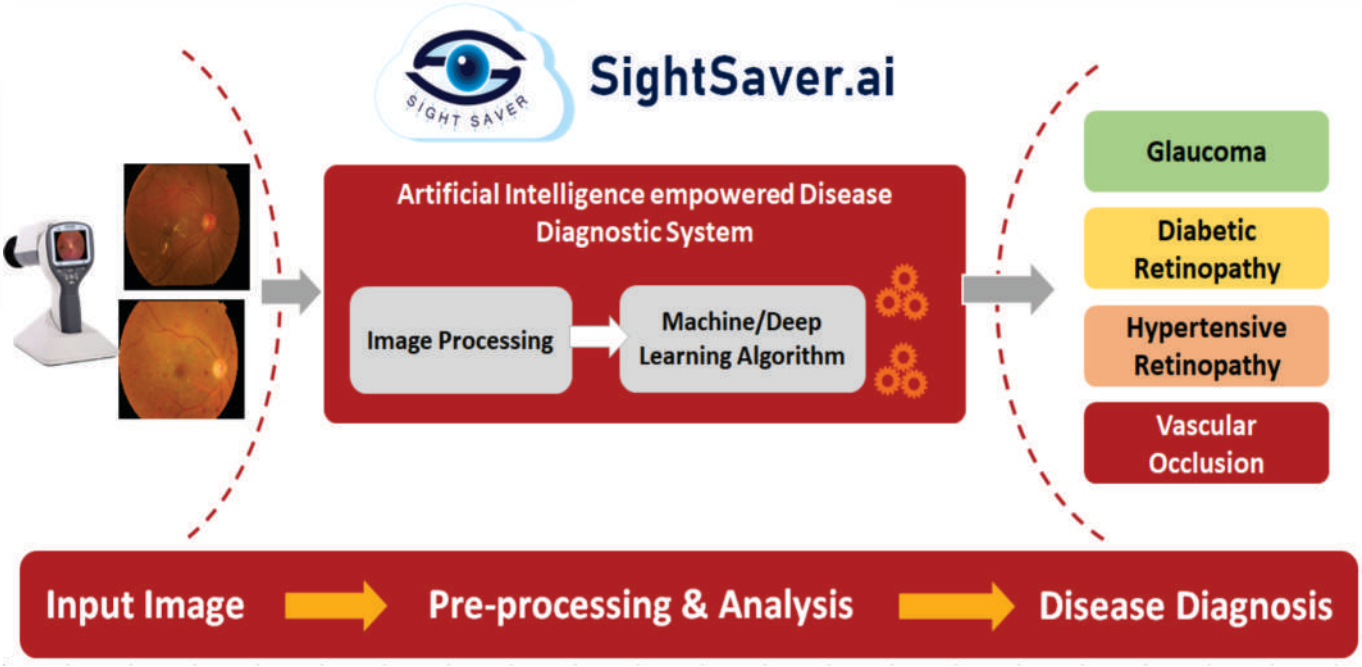
Mental health and normalcy augmentation system (MANAS) is a comprehensive, scalable, national digital wellbeing platform for the age group of 15 to 35 years. It is bilingual responsive user-friendly interface with plug and play architecture to integrate scientific and evidence based mental wellbeing contents developed by NIMHANS Bengaluru and AFMC Pune. MANAS dashboard is developed for content work flow management and visualization board for exploratory statistical analysis. MANAS is supported by Ministry of Health and Family welfare (MoHfW), Govt of India to outreach the mental wellbeing programmes by conducting Manas Mitra webinar series. MANAS has a privacy and security features with multifactor authentication, visualization dashboard, user management, content management, session and role based management and launched in April 2021.




*MANAS Android App with bilingual support*

## Disease Diagnostic System for Detection and Classification of Chronic Illness

Disease Diagnostic System for detection and classification of chronic illness is an Artificial Intelligence empowered non-invasive method for diagnosing chronic illnesses using fundus images. The solution has been developed to detect and classify the chronic illnesses like Diabetic Retinopathy, Hypertensive Retinopathy, Vascular Occlusion, Glaucoma and Retinitis Pigmentosa from retinal fundus images, which is helpful in automated disease diagnostics at early stages.




*Disease Diagnostic System from Retinal Fundus Images*

## Health Standards

### C-DAC's Toolkit for LOINC (CLNtk)

C-DAC's Toolkit for Logical Observation Identifiers Names and Codes (LOINC) is a specially designed FOSS toolkit for easy access and integration of LOINC standards in health care applications. LOINC is an international standard for identifying health measurements, observations, and documents. CLNtk is useful in the integration, validation, and processing of LOINC data for a variety of use cases such as LOINC based health records and reports sharing, enable integration of standard codes in healthcare applications, Enable hospitals/clinics in processing and analyzing health records in a standardized manner, and Assist Laboratory Management Systems (LMS) in searching, mapping, and accessing LOINC codes based on multiple parameters referred in laboratory tests (such as domain, specimen, test methods, test devices, etc.). The LOINC toolkit (CLNtk v1.0) was released on May 28, 2021

### 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 in healthcare systems/applications. The release covers generic medicines, 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 major government programs and medicines used in major health organizations/institutes from India. The CDCI package was released to refer to the July 2021 SNOMED International Edition to support concrete Domain changes in National Extension.

### C-DAC's SNOMED CT Toolkit (CSNOtk) v7.0

CSNOtk is a specially designed toolkit for easy access and integration of SNOMED CT in health care applications. SNOMED CT is comprehensive clinical healthcare terminology provided by SNOMED International. The released version of the toolkit supports more API parameters to support received filtered and precise search results. The released version of the toolkit is upgraded to support Apache Lucene v8.7.0. It has enhanced Search API to support exclusion parameters. CSNOFinder browser enhanced support exclusion parameters.

### India AYUSH Extension

Ministry of AYUSH, Government of India has initiated an effort for developing standardized clinical terminology for Ayurveda, Siddha, and Unani systems of medicine as National Extension to SNOMED CT. The India AYUSH extension is developed under the National Resource Centre for EHR Standards (NRCeS) project, for documenting essential clinical information for Ayurveda, Siddha, and Unani systems of medicine. The current release supports Ayurveda, Siddha, and Unani systems of medicine. The AYUSH extension was updated on October 8, 2021 and February 04, 2022. The Terminology Integrated Package is freely available to all the SNOMED CT Affiliates in India.

## Research Initiatives in Health Informatics

### Assessment Tool for Autism

Automatic Assessment Tool has been developed to detect Autism using Visual Attention (both Attention Analysis and Eye Gaze), Facial Expression Recognition and Vocal Emotion Recognition. The tool is based on Deep Learning based Artificial Intelligence (AI) technique. The system helps in determining the cognitive level and assists in improving the cognitive- affective faculty of people with Autism Spectrum Disorder (ASD). The tool has been deployed and in use at National Institute for the Empowerment of Persons with Intellectual Disabilities (NIEPID), Kolkata since January,2022.

### AI in Oncology

The initiative has been was jointly conceived by C-DAC and All India Institute of Medical Sciences, New Delhi for harnessing big data and advanced computing to provide personalized diagnosis and treatment for Cancer patients" (iOncology.ai). The objective is to establish a methodology for early detection of the India centric cancer by interrogating the medical and non-medical data sets using AI technology (e.g. Machine and Deep-learning). The system will assist oncologists, radiologists, pathologists in risk assessment, diagnosis, planning cancer treatment and care, prediction of patient prognosis/ Quality of Life

# Education and Training

C-DAC's Education and Training group has been developing skilled resources as part of the Skill India Initiative. C-DAC offers Post Graduate Diploma as well as Post Graduate Degree programmes for its internal human resources needs of Research & Development activities as well as IT industry. These skill enhancements ICT training courses are imparted by C-DAC training centres as well as Authorised Training Centres (ATC) spread across India. C-DAC is also involved in developing skilled resource personnel under FutureSkill Prime program of the Govt. of India.
C-DAC's training and education division is involved in the following activities:

- Post Graduate Diploma Courses in ICT
- Education and Training Technologies
- Comprehensive Recruitment System
- IT and Skills development programmes for Capacity Building

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

## Education and Training Technologies

### e-Learning System and Solutions

#### Learning Management System (LMS)

Under FutureSkills Prime program, bridge courses in Artificial Intelligence and AR-VR are offered by C-DAC. These courses are hosted at EdCast Marketplace and the registered candidates are re-directed to the LMS of the respective course conducting centre. LMS solution hosts the online courses and integrated with EdCast Marketplace. The solution has been integrated using Learning Tools Interoperability, SAML SSO (with Edcast) to offer single sign on, trigger course activity completion using xAPI (Experience API), build Virtual Lab environment with lab systems (ParamShavak). The courses are authored using multimedia content (video, ppts, pdfs etc.) and lab sessions using this platform.

#### Data Visualization Dashboards

Selection to the post graduate diploma programs offered by C-DAC is through C-CAT national examination. An open-source tool (Grafana) has been modified and configured to provide the real-time information to various stakeholders of the process such as AC/AMC committees, Marketing and Promotions team, Training Centre Network Management Team (TCNM) related to the overall process.


*C-CAT Information Dashboard*

### Centralized Online Admission and Counselling Solution

The Centralized online admission and counselling solution for Diploma & ITI courses was provided to Punjab State Board of Technical Education & Industrial Training (PSBTE), Himachal Pradesh Takniki Shiksha Board, Dharamshala (HPTSB), Directorate of Technical Education Vocational and Industrial Training, Sundernagar Himachal Pradesh (ITI). The solution comprises integration of email & SMS alerts, online payment gateway, online verification of documents, application & admission fees, generation of reports like fee challan, e-allotment letters, etc. to transform the application and admission process in educational institutions across the state of Himachal Pradesh and Punjab to increase accuracy and the response time. 80855 (students), and 528 (Institutes) effectively used the solution.

### Process Automation for Competitive Exams (PACE)

PACE focuses on providing a platform for reputed competitive exams like GATE, JAM. It does automation of various stages like candidate registration, online application filling, application scrutiny, exam centre allocation, admit card generation, result processing (answer-key verification, answer-key challenge, Question complexity identification, and various statistical information), scorecard generation, choice filling, application scrutiny for admission, seat counselling. An instance of the solution is deployed for GATE, JAM, and NBE and catered to around 9 Lakh candidates.

### Online Portal for Navodaya Vidyalaya Samiti Schools

An online portal was provided to enable candidates to register for admission to class IX & XI of Navodaya Vidyalaya Samiti Schools. In class IX & XI 2.64 Lakh plus candidates & 64000+ candidates registered respectively.

## Online Examination

### Comprehensive Recruitment & Online Examination System for Indian Air Force and Indian Coast Guard

C-DAC has designed and developed Comprehensive Recruitment and Online Examination system for the selection of candidates in Indian Air Force and Indian Coast Guard. The system involves development of Website and Online Registration, Admit Card generation, Pre-exam portal, Authoring tool, Examination software, indigenous BOSS PXE, Reconciliation, Exam Conduction, Result Processing System and Post-Exam activities, etc.
Various Online Exams were conducted during the year as given below:

- C-DAC has conducted AFCAT (Air Force Common Admission Test) exam for selection of candidates in Flying Branch, Ground Duty Officers (Technical & Non-Technical) across 100 cities of India. Total 3,18,212 candidates have been registered for AFCAT.
- C-DAC has conducted STAR exam to join as Airmen in Group 'X' (Technical) and Group 'Y' (Non-technical) trades. Total 6,31,528 candidates have been registered for Airmen.
- C-DAC has conducted Coast Guard Enrolled Personnel Test (CGEPT) for Navik and Yantrik categories of Indian Coast Guard across 75 cities. Total 6,12,862 candidates had registered.

## Post Graduate Diploma in ICT Courses

C-DAC, have conducted PG Diploma Courses, Diploma courses and Certificate Courses of NSQF level 7 and 8. C-DAC is conducting the Post Graduate Diploma Courses in the areas of ICT and Electronics. This September 2021 batch C-DAC had launched the Post Graduate Diploma courses in fully online mode. While for the March 2022 batch C-DAC has launched the Post G Diploma courses such as VLSI design, Embedded, HPC, IoT, IT Infrastructure Systems & Security which are Hardware related in hybrid mode where in 40 to 50 percent delivery will in physical classroom mode and courses such as Advanced Computing, Mobile, Big Data Analytics, and Artificial Intelligence which can be done in online mode. The All the PG-Diploma courses are of 900 hours duration, delivered online within 30 weeks duration which is 6 weeks more than physical batch to provide additional focus to course coverage over online mode.

1. C-DAC's PG-Diploma courses in (11) eleven ICT domain areas include:

i. PG-DAC : PG-Diploma in Advanced Computing
ii. PG-DESD : PG-Diploma in Embedded Systems Design
Iii. PG-DGi : PG-Diploma in Geoinformatics
iv. PG-DAI : PG-Diploma in Artificial Intelligence

v. PG-DRAT : Post Graduate Diploma in Robotics & Allied Technologies
vi. PG-DIoT : PG-Diploma in Internet of Things
vii. PG-DMC : PG-Diploma in Mobile Computing
viii. PG-DITISS: PG-Diploma in IT Infrastructure, Systems and Security
ix. PG-DVLSI : PG-Diploma in VLSI Design
x. PG-DASSD: PG-Diploma in Advanced Secure Software Development
xi. PG-DHPCAP: PG Diploma in HPC System Administration

These courses commenced across India for September 2021 batch on 21st September 2021 and completed on 16th April 2022. The March 2022 batch commenced on 8th March 2022 on the International Women's Day eve. A total of 3882 students were trained across centres for the September 2021 batch. For March 2022 batch over 4473 students joined C-DAC ACTS courses.

### National Common Campus Placements Programme (NCCPP)

National Common Campus Placement Programme (NCCPP) was organised in online mode for the students, who successfully complete the C-DAC PG-Diploma courses. Overall placement percentage achieved for the May 2021 batch students is 97% .

### Corporate Training

C-DAC conducted training through IT courses for the personnel of IAF in the areas of Java Programming, Linux Administration, Oracle 19c data base and Windows Server Administration. The training commenced for the Indian Air Force personnel from November 08, 2021 onwards. The trainings in the one batch of all the IT domain has completed. We have trained over 80 IAF personnel in the IT domains.

C-DAC conducted the training in the areas of Cyber Security areas for the newly joined batch of Telecom Officers undergoing training at National Telecommunications Institute for Policy Research and innovations Technology.

C-DAC conducted the training of the employees of National Water Academy, Pune online on the Python Programming and Java Script.

C-DAC conducted the online course in basic office automation course for the employees of the Power Grid Corporation, Nagpur.

## Post Graduate Master Programme

- 25 Students enrolled for M. Tech. in Artificial Intelligence & Machine Learning and 17 students for M.Tech. in Cyber Physical System which is offered in collaboration with Vellore Institute of Technology (VIT), Chennai.
- M. Tech in Artificial Intelligence, Cyber Security and Embedded Systems in collaboration with IK Gujral Punjab Technical University, Jalandhar for which 7 students enrolled in Embedded System discipline and 11 in Artificial Intelligence.

## Industry Academia Collaborative Programs

### FutureSkills PRIME

FutureSkills PRIME (Programme for Re-Skilling/Up-Skilling of IT Manpower for Employability) provides an up-skilling/re-skilling ecosystem in emerging and futuristic technologies to facilitate continuous enhancement of skills as well as knowledge of IT professionals in line with their aspirations and aptitude. It encourages any-time, any-where, continuous self-paced learning for acquiring newer and industry relevant skill-sets. There is a requirement 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. These programs have to be conducted 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 conducted by C-DAC/NIELIT/NASSCOM Centres/content providers across the nation through Hub-n-Spoke mode. More than 6.36 lakhs IT Professionals have signed up and over 3.23 Lakh course enrolments have been done. Also, 4.64 Lakh Digital Fluency Badges were issued on FS-PRIME Portal.

### Training Programme for MeitY and Its associated Organizations Officials

C-DAC organized three entry-level induction training programmes for S&T and Non-S&T officers of MeitY and its associated organizations. Officials from MeitY, NIELIT, STQC, and ERNET were trained during the said training programmes.

### Facilitation of IT Enabled Trainings for Health Care Workers (HCW)

C-DAC has been chosen as a technology enabler along with AIIMS Delhi to impart online professional training to 6500 Health Care Workers (HCW's-final year medical students & Interns), of medical institutions across the country, on various aspects of General Pandemic and Covid-19 management. The project would meet the need for an increased no. of trained HCW's, in the country, in general pandemic management and Covid-19 pandemic management through online training of 6500 HCW's across the country.

### Master Trainer Training

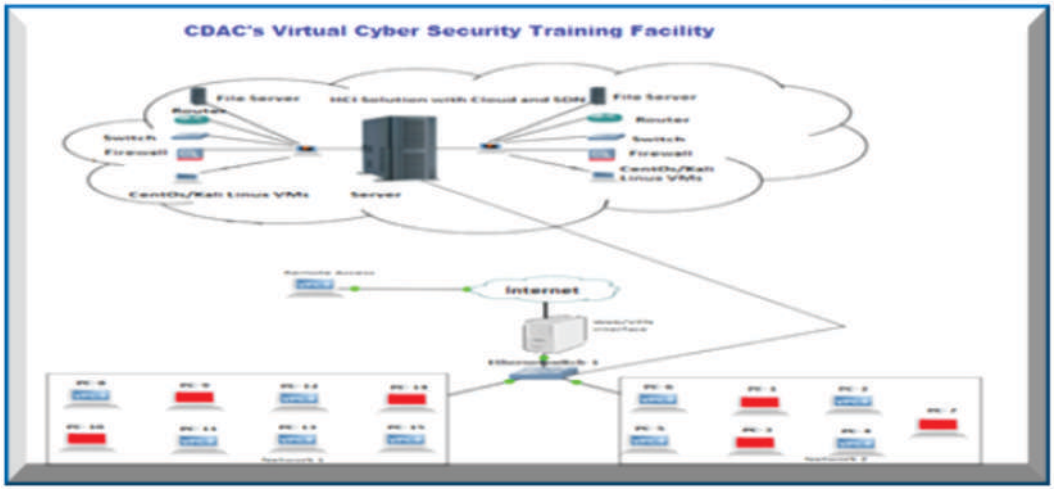
4 Master Trainers Training programs for approx. 58,276 Teachers from various CBSE Schools State Boards, College lectures from the states of Rajasthan, and many other states were conducted in collaboration with State Education Boards.

### C-DAC's Virtual Cyber Security Training Facility

A Collaborative and Comprehensive Live Cyber Operations Specific Exercise Training Facility for Indian Cyber Space (Cyber CLOSET) has been setup under the project to prepare and enable Indian critical Infrastructure organizations to test the Physical IT infrastructure, processes, and People (PPP) against cyber-attacks. A wardrobe of around 300 live, real time, simulative and readymade cyber security exercises has been developed for capacity building and cyber preparedness.

More than 1600 personnel have been trained to cope up with and recover from a hostile cyber-attack along with the identification of weaknesses in their existing cyber security implementations to improve their security measures and policies. Total 38 training programmes have been conducted for various organizations like IB, MoD, DoT, Vigyan Prasar NCIIPC, NABM, BSF, CISF, Indian Oil, ONGC, POSOCO, NRLDC, GAIL, IRCTC, NSG, Tata Power, Ordinance Board, Punjab Police, and various banks, etc.

During the Cyber Security Awareness Month October 2021, a course consisting of short online sessions was designed, developed and hosted on My Gov platform for general people including short videos, quizzes, and certificates in association with CERT-In. More than 180,000 citizens attended these sessions and downloaded the certificates.




*Virtual Cyber Security Training Facility*

# Outreach initiatives

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

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. The models are

- Collaborative Innovation Model
- Transfer of Technology
- Contract R&D
- Expression of Interest for Channel Partners & Technology Development Partners
- Request for Proposal

## Outcome of Collaborative Innovation Model

We have introduced Intent of Association for Collaborative Innovation with private entities which are enabling us to take out research output to the market after suitably finishing the product as per the market demands. Through this mode, we have successfully signed up with private partner for providing a secure platform based on blockchain for management of IoT devices.

### 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 Electronic Stethoscope, High Accuracy Data Acquisition Device for Breast Cancer Detection (MSBC DAQ), CoSiCoSt (Composite Signal Control Strategy), CUTE (Urban Traffic Control Equipment), TraMM (Traffic Signal Monitoring and Managing Software), Digital control technology for solar inverters, Smart Energy Meter.

## Product & Services Sales Through GeM

Since the inception of PS&O team, a special focus has been given for publishing the products on GeM platform. It is our pleasure to inform you that we have published 32 products and services on GeM platform. Some of the products published are IoT Research Lab Kit, USB Pratirodh, 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.

In addition to the above, partial list of noteworthy business projects executed are Long-Range Identification and Tracking (LRIT) system, Cyber Security and Information Security Services, Cyber Forensic products and analysis, Online Monitoring and Accounting System for Public Woks Deptt of J&K Govt, e-Sign Services, Online Exams for Defence Forces, MeghSikshak - an e-learning Platform, IoT based Lab Kits.

We also are undertaking appreciable efforts for capacity building through our ACTS training initiative pan C-DAC in niche domains.

### Engagement with NASSCOM

C-DAC participated in Bengaluru Tech Summit 2021 for exhibiting state of the art technologies and products. Industry roundtable arranged with NASSCOM also attracted numerous organizations for engaging with C-DAC on plethora of technological fronts. Along with NASSCOM, Go to Market pitch deck was curated and after deep dive sessions, the top common tasks for each product line along with business plan after mapping relevant milestones is in progress.

### Engagement Through Social Media

LinkedIn, Twitter, Koo, Facebook, YouTube are increasingly used to disseminate various events and technology developments on a daily basis.

# Resources, Facilitation Services and Initiatives

## International Collaborations/Initiatives

With the support from Ministry of External Affairs (MEA), C-DAC extends its expertise in ICT to collaborating nations and nurture their ICT centres. During the year, the following activities were carried out as part of this initiative: **Delhi**

- Completed set up of Egypt Centre of Excellence in IT (IE-CEIT) at Al Azhar University Cairo, Egypt and C-DAC experts were deputed at IE-CEIT for centre coordination and course delivery.
- Completed the setup of Nauru Centre of Excellence in IT (IN-CEIT) at Yaren in October 2021. Two C-DAC experts were deputed at IN-CEIT for centre coordination and course delivery.
- Completed the setup of Cook Islands Centre of Excellence in IT (IC-CEIT) at USP in Rarotonga in May 2021. Two C-DAC experts were deputed at IN-CEIT for centre coordination and course delivery.
- Namibia Centre of Excellence in ICT (IN-CEIT) & HPC at NUST in Windhoek is currently in operation with three advanced programmes and trained more than 143 students from industry, government organization, Ministries and universities, of which 122 students had qualified by end of the year 2021.
- Completed the training of AITI-KACE FOSS team at Bolgatanga and developed Ghana EduOS with education applications and simulations for the easy learning. IT Infrastructure for BOSS, IoT & SQA Labs were delivered and is under installation at AITI-KACE Ghana.
- Trained more than 240 students in nine certificate courses by C-DAC experts along with assistance of Master Trainers from Centre of Excellence in IT (CEIT) at Papua New Guinea. The experts have also carried out multiple Workshops / Seminars / Guest Lectures. Centre of Excellence in IT (CEIT) at Port Moresby, Papua New Guinea is formally handed over to the University of Papua New Guinea (UPNG) on November 8, 2021 by C-DAC.
- Completed 24 (Twenty-Four) months of IT specialized training activities for five certificate courses by C-DAC experts alongwith the assistance of Samoan master Trainers at Samoa Centre of Excellence at Apia. IS-CEIT at Apia - Samoa is formally handed over to National University of Samoa (NUS), Apia, Samoa on August 26, 2021 by C-DAC.
- Completed training activities more than 80 participants with 6 certificate courses by C-DAC experts along with assistance from Niue experts at Niue Centre of Excellence in IT (CEIT) at Alofi.
- Under the extension of India Myanmar Centre for Enhancement of IT Skills (IMCEITS) at Yangon, C-DAC shared Syllabuses/Source Books for all the approved courses to IMCEITS. A Faculty Development Program (FDP) has been conducted for 32 faculties from IMCEITS & associated Universities of Myanmar during July-August 2021 in Artificial Intelligence domain.
- Completed the training of 20 Jordanian Master Trainers at C-DAC Resource Centre in Noida and returned to Amman. Also completed shortlisting of the candidates for the post of 'Technical Advisor' at NexGen Centre of Excellence in IT at Hashemite Kingdom of Jordan.
- Completed Installation & commissioning of IT Infrastructure and Cyber Forensic Tools at India - Syria NexGen Centre of Excellence (NexGen IS-CEIT) at Damascus in September 2021. Courseware was supplied at NexGen IS-CEIT in August 2021.
- Completed supply of Courseware in June 2021 and shipment of IT Hardware & Software for India – Argentina Centre of Excellence in IT is underway.
- C-DAC Pune supports the National Release Centre for SNOMED CT in coordination with SNOMED International as part of the National Resource Centre for EHR Standards (NRCeS) project funded by Ministry of Health & Family Welfare (MoHFW).

# Patents

## Patents Awarded

1. "Multichannel Wireless Personal area Network (Wpan) Gateway Device And An End Device", Inventors: David Selvakumar, Kiran Nayak, Kaushik Nanda, Hari Babu Pasupuleti, Patent No. 382352, Awarded on 23.11.2021
2. "Visual Aid System for Visual Monitoring of A User In Accordance With Pre-Defined Parameters", Inventors: Raja Thevar Pitchiah and Chidambaram Sethukkarasi, Patent No. 379508, Awarded on 20.10.2021
3. "An Automation System for Recipe Management in a Defined Environment", Inventors: Raja Thevar Pitchiah and Verma Amit Kumar, Patent No. 380558, Awarded on 28.8.2021
4. "An Automation System for Kitchen Cabinets Adapted To Manage Stocks Of Items Stored In Said Kitchen Cabinet", Inventor: Raja Thevar Pitchiah and Verma Amit Kumar, Patent No. 380600, Awarded on 14.1.2022
5. "Automation System for Trial Rooms in a Store for helping a User of a Trial Room in respect of items that are being tried on at the Store", Inventors: Raja Thevar Pitchiah and Chidambaram Sethukkarasi, Patent No. 375416, Awarded on 25.1.2021
6. "Wireless Dimmable Lighting System with Heat Dissipation Capability", Inventors: Raja Thevar Pitchiah, Sabarimuthi Irene, Govindaswamy Dhivya and Gunasekaran Rekha, Patent No. 379312, Awarded on 13.10.2021
7. "System and Method for storing, retrieving and managing course structure in relational database", Inventors: M. Uday Kumar and Sandesh Jain, Patent No. 389312, Awarded on 15.02.2022
8. "A Field Portable Uniform Illumination Imaging Biosensory System (UIIS) for Remotely Screening Chemical Contaminants in Agri Based Setup", Inventors: Dr. Nabarun Bhattacharyya, Dr. Sunil Bhand, Dr. A. K. Barooah, Subhankar Mukherjee, Abhra Pal, Souvik Pal, Devdulal Ghosh, Subrata Sarkar, Arun Jana, Ravi Sankar, Dr. Raktim Pal, Dr. Sangeeta Brochetia, Patent No. 380800, Awarded on 29. 10. 2021
9. "A Transducer Less Computing unit for Electric parameters and a Method thereof", Inventors: Latha Kaimal, Sindhu R, Titus A Chazhoor, Sudeep Balan and Vijaya Bhaskara Rao, Patent No. 373426, India, Awarded on 30. 7.2021
10. "Device and Method for detecting Double talk condition and cancelling the returned Echo from received speech signal in a two-way communication system", Inventors: Simon Zachariah, Satheesh Prabhu, Soumya Murali and Annu Liza Jose, Patent No. 382355, India, Awarded on 23. 11. 2021
11. "Method and System for Integrating a 360 Degree Rotating Camera in to a Mobile Phone", Inventors: Deepa Sivan, Krishna Kumar Rao, Sanjeeva Rao, Biju Cheriyan Oommen, Patent No. 384462, India, Awarded on 24.12.2021
12. "A secure Programming interface for non-volatile memory in an embedded device", Inventors: G. Gopakumar, R. L Vipin, S. Krishnakumar Rao, Thomas Joseph, R. Ravindra Kumar and Biju C Oommen, Patent No. 389487, Awarded on 16.02.2022
13. "Method and system for tracking global map in a solar panel array", Inventor: Subhash Joshy, Patent No.377706, Awarded on 23.09.2021.

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1. "Smart Gateway Device", Inventors: Vaibhav Pratap Singh, Mohanasundaram S V, Tulasi Dwarakanath V, Kaushik Nanda, Haribabu P and Bindhumadhava B S, Indian Patent Office: 202111023481, Filed on 26.05.2021
2. "A System for Intelligent and Interactive Museum Exhibit and Method Thereof", Inventors:
   Kunal Chanda, Washef Ahmed, Souvik Banik, Debasis Mazumdar, Nataraj Dasgupta and Satadal Ghosh, Indian Patent Application No: 202231002054, Filed on 13.01.2022
3. "e-SAHI: A system for real time verification of signature and method thereof", Inventors: Asok Bandyopadhyay, Abhisek Hazra and Barnali Pal, Patent Application filed in India under application no. 202131046074, CBR

Number – 13351, Filed on 09.10.2021

4. "Glacier Water Level Sensor system (GWALS)", Inventors: Haneesh Sankar T P, Dayakar, Harikrishnan C, Sindhu R, Anish S and Arun K K, Application No. 202141016706, India, Filed on 9. 4. 2021
5. "A Non-invasive Plant Wearable System for Early Detection of Red Palm Weevil Infestation and Method thereof", Inventors: Nimmy Pathrose, Rajesh K R, Parvathy S R, Deepak Jayan P, Govind S, Syam, Lekshmy Janardhanan, James Varghese, Vishnu S and Nimmy Mathew, Application No. 202141045880, Filed on 18. 8. 2021
6. "System and method for controlling voltage across switching devices present in circuit", Inventors: Kamalesh Hatua, Vamshi Krishna Miryala, Saravanan (IITM) and Ganesan Perumal, Application No: 202041031481

## Copyrights

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1. "ASR Enabled Dynamic Template Generation For HMIS", Inventors: Priyesh Ranjan, Ayush Kumar Sumit Soman, Umesh Sharma, Pragya Sharma, A S Cheema, Praveen K Srivastava and Vivek Khaneja, Copyright Registration No: SW-14585/2021, India, Awarded on 28.05.2021
2. "QR Code based e-Visit with Geo Fencing, Live Queue No feed and Digital Payment features", Inventors: Priyesh Ranjan, Sudeep Rai, Amit Kumar Ateria, Ashutosh Kumar and Praveen K Srivastava, Copyright Registration No: SW-15314/2022, India
3. "Embedded Linux based application software for collecting Wi-Fi Sensor data in DSRC based On Board Unit", Inventors: Shalu R, Lijo Thomas and Jerry Daniel J, Copyright Registration No.: SW-15004/2021, India, Awarded on 21.10.2021
4. "Imaging and Vision Development Tool (IVDT)", Inventors: Jerry Daniel J, Sreedhanya L R, Murugan Saivam and Nithin P V, Copyright Registration No. SW- 14554/2021, India, Awarded on 20. 5. 2021
5. "IEC61850 standard Communication Service for Digital Substation", Inventors: Sudeep Balan, Sreedhanya L R, Vijaya Bhaskar Rao and Sreeja D, Copyright Registration No. SW-14511/2021, India, Awarded on 11.05.2021
6. "Bus stop Survey App: Mobile App to capture geo-location and attributes for bus stops", Inventors: George Thomas, Abey S.A, Rajesh R and Alexander G, Copyright Registration No. 8612/2021-CO/SW
7. "Turbo shaft Engine Control Software", Inventors: Shibu R M, Rajesh R and Sanjeev Kumar H, Copyright Registration No. SW-14925/2021, India, Awarded on 13.8.2021
8. "Sensor Data Acquisition Software for Driver Assistance And Warning System", Inventors: Rajesh K R, Nimmy Mathew, Vishnu S, Renjith M and Divya M H, Copyright Registration No. SW-15071/2021, India, Awarded on 17.11.2021
9. "BPRS & DTPC Server software application and configuration utility for capturing real time traffic information using Wi-Fi Sensor data and GPS, Gyroscope and Accelerometer sensor data from the DSRC based On Board Units via Road Side Unit", Inventors: Rakesh G, Lekshmi G, Shalu R, Lijo Thomas and Jerry Daniel, Copyright Registration No. SW-15021/2021, India, Awarded on 21.10.2021
10. "Verification Firmware for Seriel Peripheral Interface (SPI) Master Controller", Inventors: Sreenadh S and Sreeju G R, Copyright Registration No. SW-15019/2021, India, Awarded on 25.10.2021
11. "Intelligent Micro grid Manager (IMM) for Micro grid", Inventors: Brijesh P, Arya G Lal, Vishnu Syam and Aby Joseph, Copyright Registration No. SW-15056/2021, India, Awarded on 30. 9.2021
12. "MaxSim: Maxillofacial Surgery Planning and Simulation System", Inventors: Deepak M, Ranjith K O, Byju N B, Devanand P and Alexander G, Copyright Registration No. 8072/2021-CO/SW, India, Awarded on 11.05.2021.

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1. "Chlorophyll estimation for Paddy", Inventors: Tamal Dey, Sabyasachi Majumder, Gopinath Bej, Abhra Pal, Anshuman Chakraborty, Hena Ray, Amitava Akuli, Ravi Sankar, Alokesh Ghosh and Nabarun Bhattacharyya, Diary No. 30072/2021-CO/SW dated 13/12/2021

2. "Seedling count estimation for Paddy", Inventors: Tamal Dey, Sabyasachi Majumder, Gopinath Bej, Abhra Pal, Anshuman Chakraborty, Hena Ray, Amitava Akuli, Ravi Sankar, Alokesh Ghosh, Nabarun Bhattacharyya, Diary No. 30126/2021-CO/SW dated 13/12/2021
3. "Silk content estimation in cocoons", Inventors: Tamal Dey, Sabyasachi Majumder, Gopinath Bej, Abhra Pal, Anshuman Chakraborty, Amitava Akuli, Alokesh Ghosh and Nabarun Bhattacharyya, Diary No. 30124/2021-CO/SW dated 13/12/2021
4. "Plant growth estimation for Paddy", Inventors: Devdulal Ghosh, Ravi Sankar, Soumik Layak, Sangit Saha, Hena Roy, Alokesh Ghosh and Nabarun Bhattacharyya, Application no- 30119/2021-CO/SW dated 13.12.2021
5. "eRT-OHM, Software for electronics enabled olfactory health monitoring of storage commodities", Inventors: Anshuman Chakraborty, Hena Ray, Ravi Sankar, Alokesh Ghosh, Nabarun Bhattacharyya, Somnath Das and Tarun Kanti Ghosh, Diary No. 30169/2021-CO/SW Dtd. 14.12.2021
6. "TvITS- Thermal Vision Sensor for ITS Applications", Inventors: Sathyanarayanan K, Prakash R, Benoygopal E B, Satheesh G and Sajitha M, Application No. 25091/2021-CO/SW, Filed on 15.10.2021
7. "Vehicle Presence Detector (VPD)", Inventors: Sathyanarayanan K, Vidya V, Prakash R, Benoygopal E B, Balan C and Satheesh G, Application No. 25096/2021-CO/SW, Filed on 17.01.2022
8. "Verification Firm wire for Programmable Timer Controller", Inventors: Sreenath S and Sreeju G R, Application No. 25101/2021-CO/SW, India, Filed on 20. 10.2021
9. "Red Palm Weevil Detection Firmware", Inventors: Nimmy Pathrose, Rajesh K R, Parvathy S R, Mr. Deepak Jayan P and Vishnu S, Application No. 26151/2021-CO/SW, India, Filed on 29. 10.2021
10. "Buried Object Recovery Software (BORS)", Inventors: Joby Thomas, Parvathi M.S. and Rakhi Sasidharan, Application No. 30552/2021-CO/SW, India, Filed on 17.12.2021
11. "Buried Object Tracking and Recording Software (BOTS)", Inventors: Joby Thomas, Parvathi M.S. and Rakhi Sasidharan, Application No. 30791/2021-CO/SW, India, Filed on 17.12.2021
12. "Software for Remote Access Using Serialization & De serialization", Inventors: Subodh P.S., Nimmy Mathew and Rakhi Sasidharan, Application No. 30881/2021-CO/SW, India, Filed on 21.12.2021
13. "DLMS/COSEM Compatible Single phase Smart Energy Meter", Inventors: Sreedevi V.S., Jiji K. and Priya S, Application No. 30898/2021-CO/SW, India, Filed on 21.12.2021
14. "Echo Sound Control & Communication Firmware", Inventors: Shibu R M, Rajesh R, Arun Gopalakrishnan and Abhijith M S, Application No. 31012/2021-CO/SW, India, Filed on 22.12. 2021
15. "Submarine Echo sounder MK1 Interface Software", Inventors: Ramya S, Nimmy Mathew and Subodh P S, Application No. 32051/2021-CO/SW, India, Filed on 31.12.2021
16. "CoSMiC (Common SMart iot Connective)", Inventors: Benoygopal E. B, Satheesh G, Ravikumar P, Hemant Jeevan Magadum, Aritha G and Divya Jose, Application No. 21979/2021-CO/SW, India, Filed on 17.11.2021
17. "ReACT- Rectrofit oneM2M Adaptor for C-DAC Traffic Controllers", Inventors: Benoygopal E. B, Satheesh G, Ravikumar P, Hemant Jeevan Magadum, Prakash R, Abhilash M and Mahesh Kumar M, Application No. 21983/2021-CO/SW, India, Filed on 17-11-2021
18. "Vehicle Presence Detector (VPD)", Inventors: Sathyanarayanan K, Vidya V, Prakash R, Balab C and Satheesh G, Application No. 25096/2021-CO/SW, Filed on 15.10.2021
19. "Embedded C based application software for collecting NTC Thermistor Sensor data for Thermal Sensor Based Monitoring System for the early detection and screening of breast cancer", Inventors: Jithin S and Anupama P, Application No. 2511/2022-CO/SW, Filed on 3. 2.2022
20. "Application Software for data collection and analysis of thermal sensor-based monitoring system for the early detection and scanning of breast cancer", Inventors: Lekshmi G, Manju B K, Rakesh G and Anupama P, Application No. 2499/2022-CO/SW, Filed on 3. 2.2022

# Awards and Recognitions

1. e-Mulyankan, A Real-time Price Discovery Solution for Agri-Commodities has been awarded "Agri AI Grand Challenge-2021" award for prototype solution organized by NASSCOM and Telangana Govt.
2. Digital Technology Sabha Excellence Awards has been awarded for the product titled "AnnadarpanSMART", a machine vision solution for appearance-based quality testing of rice", and "ENOVISION", An Integrated Electronic Nose and Vision System for Quality analysis of Black tea" organized by The Indian Express (P) Ltd on Digital Platform during February 23-25, 2021.
3. Telangana AI Mission (T-AIM) Grand Challenge 2021 has been awarded for "Real-Time Price Discovery & Volume management at e-Marketplaces". Awards ceremony was held on July 7, 2021, in presence of Mr. Jayesh Ranjan, IAS, Principal Secretary, Government of Telangana, Ms. Rama Devi Lanka, Director Emerging Technologies & Officer on Special Duty, ITE&C Department, Government of Telangana, Dr. V. Praveen Rao, Vice Chancellor, Professor Jayashankar Telangana State Agricultural University (PJTSAU), and NASSCOM members.


4. C-DAC has received the prestigious GovernanceNow award - 4th Digital Transformation m-Governance Awards 2021 on November 18, 2021 for its mSeva AppStore Project. Mobile Seva Appstore' is India's first indigenously developed Appstore (under 'Atmanirbhar Bharat Mission') and is initiative launched by Ministry of Electronics and Information Technology (MeitY).

5. C-DAC has received Digital Technology Sabha Excellence Award for developing and maintaining an indigenous AppStore during online award ceremony on November 18, 2021.


6. 4th Digital Transformation Governance Award in G2B services 2021 on November 18, 2021 was presented to C-DAC on November 18, 2021 for Online Solution to M-SIPS Scheme of Government of India. The e-MSIPS is an end-to-end workflow management system developed for MeitY. MSIPS, is one of the largest schemes to attract foreign investment and turn India into an electronic manufacturing hub for everything from mobile chargers to medical devices.


7. ASSOCHAM Award-2021 was presented to C-DAC for NCMC for Transit applications under the category of Fintech Digital Payment Award at Delhi on September 8, 2021.


8. C-DAC Patna has received Gold Medal for C-DAC Video Design Competition on India@2047 hosted by C-DAC Noida on 22nd December 2021 as a part of Azadi ka Amrut Mahotsav.

## Events/Conferences

1. As a part of Azadi ka Amrut Mahotsav (AKAM) Celebrations, Hon'ble Union Minister of State, Shri. Rajeev Chandrasekhar launched RUDRA PARAM Bio-Inferno on December 03, 2021.



2. Online webinar on "A Safe Healthy DNS Ecosystem" to create awareness was conducted on December 23, 2021 in collaboration with India Internet Governance Forum (IIGF).
3. PKI Awareness workshops were conducted at Mysore, Jaipur, Ghaziabad, Mount Abu and Ranchi during August 2021 to February 2022 in collaboration with Controller of Certifying Authorities (CCA).


4. 2nd International Conference on Public Key Infrastructure and its Applications (PKIA 2021) to bring all the stakeholders of PKI Ecosystem in a single platform to discuss the emerging issues was conducted at India Habitat Centre, New Delhi on December 22, 2021 in collaboration with Controller of Certifying Authorities (CCA).
5. THINK PARALLEL training was conducted to train scientists and engineers to upskill focusing HPC and writing parallel programs at Society for Electronic Transaction Security (SETS) at Chennai during November 24-26, 2021.
6. Shri. Rajeev Chandrashekar, Hon. Minister of State for Skill Development and Entrepreneurship and Electronics and Information Technology, visited C-DAC Bengaluru on October 18 2021 and seen the demonstration of C-DAC's indigenously developed software for the NSM HPC such as CAPC, ParaDE, HPC Utilities and SuMegha Private Scientific Cloud, etc.

7. C-DAC participated in the industrial exhibition hosted by Atal community Innovation Centre - Kalaslingam Innovation Foundation & Laghu Udhyog Bharati, Madurai Chapter for students, professionals and researchers during March 26-27, 2022.
8. As a part of Future Skills Prime initiative for the Cyber Security Technology, Hands-on Training on Cyber Security Essentials and Deep Dive into Mobile Application Security Analysis for Government Officials was conducted in online mode during April 26, 2021 – May 7, 2021 and November 22, 2021 – December 1, 2021 respectively.
9. 6th National Conference on E-Learning and E-Learning Technologies (ELELTECH 2021) to provide a common platform for sharing knowledge and experience of Indian e-learning community including researchers, developers and implementers was organized in online mode on October 7, 2021.
10. Future Skills PRIME Programme was launched by Shri Rajeev Chandrasekhar, Hon'ble Minister of State for Electronics & Information Technology on October 29, 2021 at MeitY, New Delhi in collaboration with NASSCOM and NEILIT. Prominent industry leaders, Shri Rishad Premji, Chairman, Wipro Ltd., Shri Anant Maheshwari, President, Microsoft India, Shri CP Gurnani, CEO & MD, Tech Mahindra & Ms. Rekha Menon, Chairperson & Sr. MD, Accenture (India) also attended this event.


11. 5 Days Faculty Development Program for "Introduction to Speech Processing and its Applications using AI-ML (ISPA) – 2021" in online mode was conducted during October 25-29, 2021.

12. As a part of celebration towards National Cyber Security Awareness Month (NCSAM 2021), Cyber Safety and Security Awareness Workshop was conducted in online mode on October 7, 2021 in collaboration with NIFT, Kolkata.
13. More than 10 Oline workshop on Introduction of Mobile Seva Appstore for various domains including Health, Fitness, Food, News & Magazine, m-Learning, etc. were conducted.
14. Online Awareness workshops for creating awareness about e-Pramaan among Government departments were conducted on July 27, 2021 and October 1, 2021.
15. A conference on "Use of AI and ICT in Agriculture Information Access and Dissemination" was conducted in online mode in collaboration with C-DAC Kolkata, BASU Patna and BAU Ranchi on March 14, 2022.
16. International Conference on Emerging Trends and Technologies on Intelligent Systems (ETTIS-2021) was conducted at C-DAC Noida during March 3-4, 2021 in collaboration with Automatic Control, Computers & Electronics Department, Petroleum-Gas University of Ploiesti, Romania.
17. Grand Challenge Contest 2021 was conducted jointly by C-DAC and India Cellular and Electronics Association (ICEA), New Delhi in online mode on December 20, 2021.


18. 5 days online ATAL-FDP program on Digital Forensics in Cyber Security was conducted in online mode in collaboration with AICTE during August 2-6, 2021.
19. Cyber Safe East India – Multi city workshops on Cyber Security for MSMEs were conducted at Patna, Ranchi and Guwahati during September 16, 2021 to October 22, 2021 in collaboration with Customer Units & Trust Society (CUTS) and U S Consulate, Kolkata.
20. Online NRCeS Webinar Series 2021 on EHR Standards Implementation was conducted during April to August 2021 for Use cases of Data Analytics and Decision Support, Developing Clinician-Friendly User Interfaces for SNOMED CT, The ABC of FHIR, FHIR for your Architecture: Structure, Communication, and Query, Achieving Healthcare Interoperability in Real World, Clinical NLP with SNOMED CT and Leveraging DICOM for Data Analytics in Healthcare
21. Workshop for Artisan and Weaver to create awareness for artisan/weave of North Eastern states for selling their products was conducted at Agartala, Tripura on January 12, 2022

22. C-DAC participated in 14th International Railway Equipment Exhibition (IREE 2021) and demonstrated the product "Rail Track Monitoring and Alert System" at Pragati Maidan, New Delhi during December 16-18, 2021.
23. Online webinar for Awareness creation on NaMPET initiatives for promoting and supporting Start-ups in Power electronics was conducted in collaboration with Engineering Science & Technology Research Park (TrEST), Govt. of Kerala on May 17, 2021.
24. C-DAC participated in the 6th conference of Transportation Research Group (TRG) of India jointly organized by National Institute of Technology (NIT) Tiruchirappalli and Conference of Transportation Research Group (CTRG-2021) and exhibited the Intelligent Transportation System (ITS) products at Tiruchirappalli during December 14-17, 2021.


25. As a part of the "Knowledge & Resource Centre for Accessibility in ICT (KAI)" initiative supported by MeitY, C-DAC has conducted various Accessibility Awareness Workshops and Capacity Building Workshops to bring out the details of the "Accessibility for ICT Products and Services Part I Requirements (IS 17802 Part 1): 2021" standard and brainstorm the implementation approaches.

    4 Awareness and 2 Capacity building Workshops on ICT Accessibility and Standards were conducted for various sectors including Education, Banking, Smart Cities and Transport sectors from December 2021 to March 2022.

## Research Papers/Publications


1. Shanmukesh P, Mahendra Lagineni, Jagan Mohan K, Senthil Kumar RK and Bindhumadhava BS, "Secure DLMS/COSEM communication for Next Generation Advanced Metering Infrastructure", Asian Journal For Convergence In Technology (AJCT) ISSN -2350-1146, Volume 7, Issue 1, Pages 92-98, 2021
2. Sanjay Adiwal, Balaji Rajendran and Pushparaj Shetty D, "A Quantitative Method for Measuring Health of Authoritative Name Servers", International Journal of Information Security and Privacy, Volume 16, Issue: 1, Pages 1-19, November 2021, DOI: 10.4018/IJISP.285582, ESCI & Scopus Indexed
3. Sanjay Adiwal, Akanksha Gupta, Balaji Rajendran and B S Bindhumadhava, "A Secure Methodology for Filtering Spam & Malware in E-mail System and Secure E-mail Testbed Setup", International Journal of Advanced Trends in Computer Science and Engineering, Volume 10, No.2, March-April 2021, ISSN 2278-3091, DOI: 10.30534/ijatcse/2021/271022021
4. Manavalan R, "Need and Impact of Data Analytics in Organic Farming Sector of India", Journal of the Indian Society of Agricultural Statistics (JISAS)", Volume 75, Issue 2, Pages 161–174, 2021 Prafullata KiranAuradkar, AtharvaRaykar, IshithaAgarwal, DinkarSitaram and Manavalan
5. R, "Accuracy assessment and performance analysis of raster to vector conversions on LULC data – India", Journal of Engineering, Design and Technology, https://doi.org/10.1108/JEDT-04-2021-0224, 2021
6. Ramesh V P, Janakiraman S, Prithvi M. and Narayani G. , "A new a priori estimation for singularly perturbed problems with discontinuous data", Indian Journal of Pure and Applied Mathematics (Springer), Online first, September 2021, https://doi.org/10.1007/s13226-021-00175-9, 2021
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9. Kirsanov, Dmitry, Subhankar Mukherjee, Souvik Pal, Koustuv Ghosh, Nabarun Bhattacharyya, Rajib Bandyopadhyay, Martin Jendrlin et al., "A Pencil-Drawn Electronic Tongue for Environmental Applications", Sensors, Volume 21, Issue 13, Pages 4471, 2021
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11. Sujoy Kumar Makar, Nageshwar Rao Lenka and Joyanta Basu, "Effectiveness of Cochlear Implant in Children with Profound Sensorineural Hearing Loss Below Poverty Line in Rural India: A Longitudinal Study", International Journal of Otorhinolaryngology, Volume 7, No. 2, Pages 6-10, 2021, 10.11648/j.ijo.20210702.11
12. Joyanta Basu, Soma Khan, Rajib Roy, Tapan Kumar Basu and Swanirbhar Majumder, "Multilingual Speech Corpus in Low-Resource Eastern and Northeastern Indian Languages for Speaker and Language Identification", Circuits, Systems and Signal Processing (CSSP), Volume 40, Issue 10, Pages 4986-5013, 2021, https://doi.org/10.1007/s00034-021-01704-x
13. Goutam Kumar Saha, "Cyber Security Issues", International Journal of Applied Research on Information Technology and Computing, Volume 11, No. 3, Print ISSN: 0975-8070, Online ISSN:0975-8089, December 2021
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18. Kumar H., Srivastava S. and Singh B., "Low power, high-performance reversible logic enabled CNTFET SRAM cell with improved stability", Materials Today: Proceedings, Volume 42, Issue 4, Pages 1617-1623, 2021
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121. Ujjwal Singh, Divya D S and Kadar A A, "Development of Virtual Reality Training module for Maithari of Martial Art Kalari", International Conference on Advances in Computing, Communication, Embedded and Secure Systems (ACCESS), IEEE, Ernakulam, September 2021
122. Parvathy S. R., Deepak Jayan P., Nimmy Pathrose and Rajesh K. R., "Convolution Auto encoder based Deep Learning Model for Identification of Red Palm Weevil Signals", IEEE International Conference on 13th Asia Pacific Signal and Information Processing Association Annual Summit and Conference 2021, IEEE Xplore Digital Library, Tokyo, Japan (Virtual), Pages 6, 2021
123. Sreejaya Varma, Sureshkumar M.S and Divya D S, ""FPGA Realization of Pulse Shaping Filter and DUC Filters for TETRA Transmitter", 2021 2nd International Conference on Advances in Computing, Communication, Embedded and Secure Systems (ACCESS), 2021, IEEE, Cochin, Pages 35-40, 2021
124. Lakshmaiah Alluri and Hemant Jeevan Magadum, "Small Delay Tracing Defect Testing", ISBN : 978-1-925953-55-8, Volume 11, Issue 21, Pages 1-6, 2021
125. S V. Nair, Harikrishnan P. and K. Hatua, "Six-Step Operation of a Symmetric Dual Three-phase PMSM with Minimal Circulating Currents for Extended Speed Range in Electric Vehicles", IEEE Transactions on Industrial Electronics, IITM, 2021
126. Satheesh Kumar S, "MemDroid - LSTM Based Malware Detection Framework for Android Devices", 2021 IEEE Pune Section International Conference (PuneCon), IEEE, Online, Pages 6, December 2021
127. Dr. Dittin Andrews, Naganna Chetty (NITK Surathkal), Dr.Sreejith (NITK Surathkal), "Computational Overview of Online Hate Content: Cognitive -AI Survey", Sixth IEEE International Conference on Computing, Communication and Security, IEEE, USA (Virtual), 2021
128. Dija S, Ajana J, Indu V and Sabarinath M, "Web Browser Forensics for retrieving Searched Keywords on the Internet", 3rd IEEE International Conference on Advances in Computing, Communication Control and Networking (ICAC3N–21), IEEE, Pune, (Virtual), Pages 1-5, 2021
129. Binu P J, Dr C Sudalaimani, Arun S et.al, "Mobile Televeterinary System with Animal Lifting and Standing Support Facility for animal care", Telemedicon-2021 International Conference, Telemedicine Society of India,

Pune, 2021

130. Jayan V and Sreejith Alathur, "Military & War Metaphor during Covid-19 in India", 6th International Conference on Computing, Communication, and Security (ICCCS-2021), IEEE, USA, 2021

131. Shobana devi P, Vidya V and Balan C, "Media files to ISL: GAN based Indian sign language Interpreter", International Conference on Electrical, Electronics, Information and Communication Technologies (ICEEICT 2022), IEEE, Tamil Nadu, 2022

## Invited Talks

1. Shanmukesh Pudi, "NESCOR guide to vulnerability assessment and Penetration Testing", Cyber Security for Power System Operation & Management, National Power Training Institute (NPTI) Bengaluru (Virtual), July 8, 2021.
2. Lagineni Mahendra, "Power Systems Communication Protocols", Cyber Security for Power System Operation & Management, National Power Training Institute (NPTI) Bengaluru (Virtual), July 6, 2021.
3. Rajesh Kalluri, "Analyzing security of RTUs using hybrid testbed", Cybersecurity Management workshop organized by IEEE, PES, Online, September 15, 2021.
4. Aneesh Ravindran, Vivian Desalphine and team, "A POSIT Arithmetic Enabled RISC-V PROCESSOR", RISC-V Summit 2021, Virtual / Physical at San Francisco, December 6, 2021.
5. Vaibhav Pratap Singh, "IoT and its Use Cases", Department of Information Technology, Kannur University, Online, September 21, 2021.
6. Kaushik Nanda, "IoT in Energy Sector", Five Days ONLINE Faculty Development Program on the Internet of Things (IoT) Sponsored by AICTE Training and Learning (ATAL), Organized by Department of Computer Science, School of Physical Sciences, Central University of Kerala, Online, March 14, 2021.
7. Shrikrishna, "IoT Protocols", India Mobile Congress (IMC) 2021 Workshop, Virtual, December 09, 2021.
8. Shrikrishna, "IoT Fundamentals and Protocols", IEEE SA DTU IoT Workshop (In-Person), DTU Auditorium, Delhi, October 28, 2021.
9. Dr. Balaji Rajendran, "Blockchain and Decentralized Model of Trust", General awareness to CRPF personnel, Central Training College, CTC (T & IT), Central Reserve Police Force, Ranchi, Jharkhand, February 23, 2022.
10. Dr. Balaji Rajendran, "DNS Ecosystem" in the Webinar on "DNS Abuse", Organized by NIXI, Online November 1, 2021.
11. Dr. Balaji Rajendran, "Digital Signatures and Public Key Infrastructure", For professionals of IETE Hyderabad, Online, July 4, 2021.
12. Ramesh Naidu L., "The Emerging Landscape of Trustworthy Explainable AI", A workshop on "AI for Cyber Security" by SETS, Chennai, Virtual, February 10, 2022.
13. Karthika V., "e-Saadhya for Special Needs Learners", Training for Teacher Educators of North East States conducted by NERIE, NCERT, Meghalaya, Online, February 10, 2022.
14. Dr. S. D. Sudarsan, "Keynote address", 5 days hands-on workshop on Internet of things (IoT): Technologies, Protocols & Applications at NIELIT Aurangabad, NIELIT Agartala and Kalasalingam Academy of Research and Education, Krishnankoil with IEEE and NIELIT, SRM Institute of Science and Technology, Tamil Nadu, March 24, 2022.
15. Dr. K. Vijay Kumar, "Framework for Adoption of Open Source Software in e-Gov. Systems", Awareness Workshop on e-Governance Standards & Guidelines, Online, January 19-21, 2022.
16. Dr. Priyanka Jain, "Simply It is about AI", Webinar Series in the context of India@75 being jointly presented by the High Commission of India and the Rajiv Gandhi Science Centre Trust Fund (RGSC), National Science Week 2021, Online, 2021.
17. Dr. Priyanka Jain, "वैज्ञानिक अनुसन्धान और भारतीय भाषाओं में शोधपत्र लेखन ,"कार्यशाला :भारतीय भाषाओं में शोधपत्र लेखन, Online, November 14, 2021.
18. Dr. Priyanka Jain, "Explainable AI (XAI) and their case studies", AICTE Training and Learning (ATAL) Academy' faculty development program on 'Artificial Intelligence and Applications', Online, February 10, 2021.

19. Dr. Priyanka Jain, "It is Simple AI, be it explainable", 2-WEEKS REFRESHER COURSE" organized by UGC-Human Resource Development Centre, Punjab University, Chandigarh on the theme: "Addressing the Challenges of Online Teaching-Learning", Online, February 20, 2022.
20. Dr. Priyanka Jain, "Ethical and Responsible AI", IC2ST-2021"International Conference on Convergence of Smart Technologies", Online, January 10, 2021.
21. Ch A S Murty, "Information Safety and Security", National Institute of Agricultural Extension Management, Online, April 28, 2021.
22. Ch A S Murty, "Cyber Security", Technical Members of National Academy of Indian Railways, Vadodara, Online, May 19, 2021.
23. Ch A S Murty, "Understanding the Dark Web", Faculty members under AICTE Training And Learning (ATAL) Academy, of NITTTER, Online, May 19, 2021.
24. Ch A S Murty, "Understanding Cyber Crimes", Centre for Industrial Consultancy and Sponsored Research, IIT, Chennai, Online, May 01, 2021.
25. Santosh Sam Koshy, "IoT Applications in Agriculture - Challenges, Opportunities and the Way Ahead, TiFAC Brainstorming on IoT, Drones and AI/ML, Online Meeting, coordinated at TIFAC, June 23, 2021.
26. P.R. Lakshmi Eswari, "Bringing More Trust, Transparency & Traceability in Blockchain Standards Interoperability", APAC Virtual 'World Blockchain Symposium', Online, June 30, 2021.
27. Ch A S Murty, "Proactive Cyber Security", Faculty and students of University of Jammu, Jammu Tawi, Online, July 12, 2021.
28. Ch A S Murty, "Incident forensic analysis for Investigation, Faculty and Students of Andhra University, Andhra Pradesh, Online, July 21, 2021.
29. Vijayalakshmi B., "Vikaspedia – a multilingual crowdsourcing platform for livelihood promotion", MANAGE, Hyderabad, Online, August 30, 2021.
30. Dr. S. V. Srikanth, "IoT and Emerging Technologies for Agriculture", Training on IoT and Emerging Technologies for Agriculture Scientists, MANAGE, Hyderabad, August 30, 2021.
31. Santosh Sam Koshy, "IoT in Agriculture, Case Studies in Pest & Disease Forewarning", AICTE-ATAL FDP at JC Bose University of Science and Technology, Online Meeting, September 16, 2021.
32. Satyanarayana N., "Overview on Blockchain Technology & Unified Blockchain Framework", National Workshop on Unified Blockchain Framework, Online, September 22, 2022.
33. Ch A S Murty, "Cyber Safety and Security awareness", DRDO, Hyderabad as part of National Cyber Security Awareness Month, Online, October 04, 2021.
34. P R Lakshmi Eswari, "Session on Secure Software Development Life Cycle", CISO training programme of MeitY, Government of India, Online, October 26, 2021.
35. P R Lakshmi Eswari, "Blockchain Technology", XV AGRICULTURAL SCIENCE CONGRESS & ASC EXPO organized Banaras Hindu University, Online, November 14, 2021.
36. P R Lakshmi Eswari, "Session on Secure Software Development Life Cycle", CISO training programme of MeitY, Government of India, Online, November 23, 2021.
37. Vivek Nainwal, "Introduction to QSim", Introductory training on "Introduction to Quantum Computing" sponsored by Ministry of External Affairs (MEA), Govt. of India for international participants under Indian Technical Economic Cooperation (ITEC) programme, Online, November 26, 2021.
38. Dr. S. V. Srikanth, "IoT Security", ISEA Workshop on IoT - Ecosystem: Security Standards and Opportunities, Chandigarh University, Chandigarh, December 1, 2021.
39. Ch A S Murty, "Social Media and Cyber Security", Association with MANAGE, Officials, Online, December 02, 2021.
40. Tapas Saini, "Overview of Artificial Intelligence-Tools and Techniques, Application of Artificial Intelligence and Sensor-based technologies in Agriculture, Online (MANAGE, Hyderabad), December 06, 2021.
41. Dr. S. V. Srikanth, "IoT and Emerging Technologies for Agriculture", Digital Applications for Promotion of Marketing in Agriculture and Allied Sectors, Online, EEI, Hyderabad, December 09, 2021.
42. Dr. S. V. Srikanth, "IoT Security, Expert Lecture on IoT Security for CVR Engineering College, Online, CVR Engineering College, Hyderabad, December 09, 2021.

43. Ch A S Murty, "Open-Source Cyber Security tools and Technologies, Faculty and Students of JNU, Delhi, Online, December 10, 2021.
44. Tapas Saini, "AI/ML for Computer Vision", 2nd International Virtual Conference on Industry 4.0 (IVCI 4.0) 2021 (online), VIT University - Chennai Campus (online), December 10, 2021.
45. Ch A S Murty, "Importance of Cyber Exercises for Cyber Security", Faculty and students of JNU, Delhi, Online, December 11, 2021.
46. Vijayalakshmi B., "E-resources in Indian languages – Vikaspedia as a case", MANAGE, Hyderabad, Online, December 12, 2021.
47. P R Lakshmi Eswari, "Session on Secure Software Development Life Cycle", CISO deep dive training under Cyber Surakshit Bharat initiative of MeitY, Online, December 16, 2021.
48. Dr. S. V. Srikanth, "IoT for Agriculture", Training on IoT for UAS Raichur, MANAGE, Hyderabad, December 20, 2021.
49. P. R. Lakshmi Eswari,"Session on Secure Software Development Life Cycle", CISO deep dive training under Cyber Surakshit Bharat initiative of MeitY, Online, January 20, 2022.
50. Dr. S.V. Srikanth, "Understanding the Advanced IoT Security Issues, Training for Cambodian Police, Online, Central Detective Training Institute (CDTI), Chandigarh, February 1, 2022.
51. Tapas Saini, "AI/ML for Computer Vision", Application of Artificial Intelligence in agriculture and allied fields (in collaboration with MANAGE, Hyderabad) (online), CCS HAU, Nilokheri (Karnal) Haryana (online), February 09, 2022.
52. Vivek Nainwal, "Introduction to QSim", Hands on QSim (For National Technical Research Organization), Online, February 24, 2022.
53. Dr. S.V. Srikanth, "Safety Alert Systems using DSRC for On Road Vehicles", Smart Mobility, TiHAN-IITH, Online, IIT Hyderabad, March 02, 2022.
54. P. R. Lakshmi Eswari, "Session on Secure Software Development Life Cycle", CISO deep dive training under Cyber Surakshit Bharat initiative of MeitY, Online, March 03, 2022.
55. P. R. Lakshmi Eswari, "Potential Applications and Practical Implementation for Efficiency, Security and Trust", Blockchain Revolution Summit, Online, February 12, 2022.
56. P. R. Lakshmi Eswari, "Evolution of Cyber Security Threats and Solutions", 5th National Conclave on Cyber Defence, SAJAG 2022, Artificial Intelligence in Cyber Security, Online, March 12, 2022.
57. Alokesh Gosh, "Application of IoT in Agriculture", Training program on ICT & Mass Media in Agricultural Extension" organized by BAU, Ranchi and MANAGE, Hyderabad, Online, May 4, 2021.
58. Alokesh Gosh, "Robotics in Agriculture - An Indian Perspective", Webinar on "Artificial Intelligence for Smart Agriculture" organized by ICAR Research Complex for Eastern Region, Patna, Online, July 22, 2021.
59. Alokesh Gosh, "Application of IoT and Robotics in Agriculture", Workshop "ICTS for Agricultural Extension: New Concepts" organized by Agricultural College, Hisar and MANAGE, Hyderabad, Online, August 24, 2021.
60. Dr. Joyanta Basu, "Systematic Listing, Counting and Reasoning", Embedding Computational Thinking to make education systems relevant for the youth, Dept. of IT, Tripura University, Online, August 9, 2021.
61. Kunal Chanda, "AI/ML in Computer vision and it's application in the Education sector", The National Institute for the Persons with Intellectual Disabilities (Divyangjan), NIEPID Regional Centre, Noida, Two days CRE on the topic Organizing Virtual Classroom, Online, February 23 & 24, 2022.
62. Asok Bandyopadhyay, "An Overview of Information and Cyber Security", Awareness Workshop, National Institute of Fashion Technology (NIFT), Kolkata, October 7, 2021.
63. Sourav Mitra, "Cyber Security", Cyber Security Week, Barrackpore Air Force Station, October 26, 2021.
64. Sourav Mitra, "An Overview of Information and Cyber Security", Cyber Security Week, Central Industrial Security Force (CIFS) Eastern Region, October 28, 2021.
65. Dr. P. K. Khosla, "eSanjeevani - The integrated National Teleconsultation System", Regional Conference on Replication of Good Governance Practices, Bhubaneswar, Odisha, December, 2021.
66. Dr. P. K. Khosla, "Emerging Trends in HPC Technologies", 2nd International Conference on Computational Methods in Science & Technology, Chandigarh Engineering College, Punjab, December 18, 2021.

67. Dr. P. K. Khosla, "Embedded Artificial Intelligence", All India Council for Technical Education's Quality Improvement Programme, National Institute of Technical Teachers Training and Research, March 21, 2022.
68. Dr. S. P. Sood, "Covid-19 & Telemedicine", Foundation Day CME, Department of Telemedicine, PGIMER, Chandigarh, April 13, 2021.
69. Dr. Sanjay P. Sood, "Covid-19 & Telemedicine", Key Note on the Foundation Day CME, PGIMER, Chandigarh, Virtual, April 13, 2021
70. Dr. Sanjay P. Sood, "Accelerating Digital Transformation in Challenging Times, eSanjeevaniOPD during Pandemic", World Telecom and Information Society Day, Virtual, May 17, 2021.
71. Dr. Sanjay P. Sood, "eSanjeevani - National Telemedicine Service" at Spotlight Telemedicine, International Summit on Innovation & Technology (Germany), Virtual, May 28, 2021.
72. Dr. Sanjay P. Sood, "eSanjeevani: Digital Health Innovation in Practice", Synapsis'21 (Telemedicine & eHealth), Kollam (Kerala), Virtual, June 20, 2021.
73. Dr. Sanjay P. Sood, "eSanjeevani - NTS: at the frontiers of Digital Health", 8th National Conference on Recent Advances in Computer Engineering (RACE-2021), Virtual, June 25, 2021.
74. Dr. Sanjay P. Sood, "Telemedicine Trends", Remote Care Management Symposium by The Asia Pacific Medical Technology Association (APACMed), Virtual, July 29, 2021.
75. Dr. Sanjay P. Sood, "BRICS Digital Health Summit", Virtual, September 3, 2021.
76. Dr. Sanjay P. Sood, "Virtual Care in the Age of COVID-19 and Beyond", Virtual Conference and Exhibition, Healthcare Information and Management Systems Society (HIMSS) India 21, Virtual, September 17, 2021.
77. Dr. Sanjay P. Sood, "Harnessing the Potential of Digital Health Technologies Policy Pathways for Value Assessment & Reimbursement", The Asia Pacific Medical Technology Association (APACMed) India, Virtual, October 7, 2021.
78. Dr. Sanjay P. Sood, "eSanjeevani – A Digital Public Good", Health Informatics Summit, Indraprastha Institute of Information Technology (IIIT), Delhi in collaboration with Asia Pacific Bioinformatics Interaction & Networking Society (APbians), Virtual, October 16, 2021.
79. Dr. Sanjay P. Sood, From "Sanjeevani to eSanjeevani", Tech4 Seva: Technology Outreach as Enabler for Inclusive, Sustainable and Affordable Healthcare", 2nd International Virtual Summit, Virtual, October 21, 2021.
80. Dr. Sanjay P. Sood, "On-line OPD and Ayushman Bharat Health Wellness Centres", Seminar, Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, Virtual, October 21. 2021.
81. Dr. Sanjay P. Sood, Panel Discussion "COVID 19 and Digital Health in India" Dakshayani and Amaravati Health and Education, World Stroke Day 2021, Virtual, October 28, 2021.
82. Dr. Sanjay P. Sood, "Telemedicine in Post Covid Era", Asia Telemedicine Symposium, Virtual, November 27, 2021.
83. Dr. Sanjay P. Sood, Panel Discussion - 17th Annual International Conference of Telemedicine Society of India (TSI), Virtual, November 12, 2021.
84. Dr. Balwinder Singh, "Autonomous Mapping, UAV sensors and specifications", Training Program on UAV, Online, November 8, 2021.
85. Rakesh Kumar Sehgal, "Expert Talk-Cyber hygiene for Individuals, Need and Challenges in maintaining Cyber Hygiene", Management of Digital Hygiene: Staying Secure in Cyber Space for Govt officials, C-DAC, Mohali, October 25, 2021.
86. Rakesh Kumar Sehgal, "Cyber Security overview", Specialized Training Programme in Cyber Attacks & Prevention Techniques, C-DAC, Mohali, September 20, 2021.
87. Saurabh Chamotra, "Email Threats: 'Infosec Hygiene in the Era of Disruptive Technology", Management of Digital Hygiene: Staying Secure in Cyber Space for Govt officials, C-DAC, Mohali, October 26-29, 2021.
88. Dr. Gurmohan Singh, "Overview of Quantum Initiatives & Computing Resources", ITEC Training on "Introductory Training in Quantum Computing" to international participants, C-DAC, Mohali, November 23, 2021.
89. Dr. Gurmohan Singh, "Introduction to quantum gates and quantum composer/Quantum lab", ITEC Training

on "Introductory Training in Quantum Computing" to international participants, C-DAC, Mohali, November 24, 2021.

90. Kapil Kant Kamal, "Insights on National AppStore mSeva AppStore", 16th India Digital Summit, Online, January 12, 2022.
91. Kapil Kant Kamal, "Mobile Governance", Awareness workshop on e-Gov, C-DAC and STQC, Online, January 21, 2022.
92. Kapil Kant Kamal, "Mobile Governance", Awareness workshop on e-Gov, 5th DIgital Transformation Virtual Conclave, Online, February 19, 2022.
93. Dr. Sasikumar, "Virtuals labs-Olabs", Webinar on "Virtual labs challenges and affordance (Olabs)" organised by CIET NCERT, Online, hosted on Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch channel, December 27, 2021.
94. Archana Rane and Suman Ninoriya, "Virtuals labs-Olabs, and Physics labs", Webinar on "Learning physics through Virtuals labs-Olabs", Online, hosted on YouTube, "NCERT official", SWAYAM Prabha DT TV Kishor Manch channel, December 28, 2021.
95. Suman Ninoriya and Priyanka Monde, "Virtuals labs-Olabs", Webinar on "Learning Chemistry and biology through Virtuals labs-Olabs, Online, hosted on Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch Channel, December 29, 2021.
96. Suman Ninoriya and Vaibhav Singh, "Virtuals labs-Olabs", Webinar on "Learning Maths and English through Virtuals labs-Olabs", Online, hosted on Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch Channel, December 30, 2021.
97. Raakesh T. And Dr. Sasikumar, "Security concern of Open-Source Software", Webinar on "Security concern of Open-source software and Virtual labs", Online, hosted on Youtube "NCERT official", SWAYAM Prabha DT TV Kishor Manch Channel, December 31, 2021
98. Dr. M. Sasikumar, "Reinventing Virtual lab: Olabs experience", 6th National Conference on E-learning and E-learning Technologies, Online, October 7, 2021.
99. Dr. M Sasikumar, "OLabs: School Labs Online, Panel discussion organised by CIET, NCERT as part of a workshop series "Use and Integration of Technology: Tools and Techniques (Disruptive technologies, AI, Virtual Labs, etc)., Online, broadcasted live on the NCERT Official YouTube channel and PMeVIDYA channels #6-12, August 16, 2021.
100. Nirmala Salam, "Blockchain and Aadhaar", AVM Conclave for Future Entrepreneur 2021-22, Online, December 23, 2021.
101. Dr. Padmaja Joshi, "Blockchain for Smart Cities", IEEE Conference on Technologies for Future Cities 2021, Online, October 9, 2021.
102. Dr. M. Sasikumar, "AI - the new Avatar", Keynote in One-week FDP on "AI and RPA"-Online, January 19, 2022.
103. Dr. M. Sasikumar-"Data Science - some challenges", Keynote for National Conference on open-source data science, Online, March 5, 2022.
104. Amarjeet Singh Cheema, "e-Sushrut Interoperability uses case", Healthcare Information and Management Systems Society (HIMSS) INDIA 21 Conferences, Online, September 21, 2021.
105. Amarjeet Singh Cheema, "AI Role in Blood Bank Automation", Blood Bank Symposium, PGIMER, Online, October 3, 2021.
106. Astha Rai, "Compliance of NDHM building blocks in eSushrut", HL7 India's FHIR India Connectathon 2021, Online, December 21, 2021
107. Gaurav Gotra, "HMIS Presentation", National Medical Record Conference at AIIMS Raipur MEDCRON 2022, AIIMS Raipur, March 12, 2022.
108. V. K. Sharma, "Increasing Internet Shutdowns", Data Breaches and Digital Liberties - Legal & Practical Landscape, International Conference on Cyber Law, Cyber Crime & Cyber Security-ICCC, November 24-26, 2021, Virtual Conference, November 25, 2021.
109. Dr. Kriti Saroha, "Supervised and Unsupervised Learning", one week e-short term course (e-STC) on Software Tools for Academicians, Researchers, and Scientists (STARS-2021), NIT Hamirpur, December 23, 2021.
110. Dr. Lakshmi Kalyani, "Electronic Evidence-emergence, challenges & newer trends", International Conference

on Cyber Law, Cyber Crime & Cyber Security-ICCC, November 24-26, 2021, Virtual Conference, November 25, 2021.

111. Dr. Lakshmi Kalyani, "Importance of Cyber forensics in Cyber Security", Induction Training program for scientists of MeitY, C-DAC Noida, October 1, 2021.
112. Saket Kumar Jha and Mr. Aditya Saha, "Cyber Security for Businesses", Awareness Generation Program on Cybersecurity for Businesses, BIA, Industry House, Sinha Library Rd, Patna, Bihar, December 17, 2021
113. Saket Kumar Jha and Mr. Jai Vagwan Singh, "Cyber Security and Cyber Hygiene", CISF Raising Day Celebration, CISF Eastern Zone-1 Headquarter, Patliputra, Patna, March 05, 2022.
114. Dr. Rajendra Joshi, "Covid-19 Drug Repurposing activities at C-DAC", EU-India workshop, Online, June 29, 2021.
115. Sunitha Manjari Kasibhatla, "Advances in Genomics", MSc student induction at Savitribai Phule Pune University, Online, November 26, 2021.
116. Dr. Subramanian Neelakantan and Ms. Lenali Singh, "Importance of Staying Connected During The Covid Environment & Role Of Standards", The Digital Dialogues on the occasion of Global Accessibility Awareness Day (GAAD)- May 20, 2021, Online, May 20, 2021.
117. Dr. Yogesh Kumar Singh, "Application of Geographical Information Systems", National Faculty Development Programme, Online, July 6-19, 2021.
118. Dr. Binay Kumar, "Glacial Lake Early Warning System", Refresher Course on "Earth, Water and Environment" for College/University teachers organized by UGC, Human Resource Development Centre, Savitribai Phule Pune University, Online, February 17, 2022.
119. Dr. Manish P. Kale, "Landuse Landcover forecasting using logistic Markov model", Refresher course on Earth, Water and Environment for College/University teachers (UGC, HRDC, SPPU, Pune), Online, February 17, 2022.
120. Dr. Santosh Kulkarni, "How Much Does Large-Scale Crop Residue Burning Affect the Air Quality in Delhi?", "International Workshop on Fires in South Asia: Current status and future challenges in modelling, predictions and mitigation", held virtually on December, 03-04, 2021.
121. Dr. Manoj Khare, "Importance and Application of Remote Sensing and GIS in Agriculture" in Birsa Agricultural University, Ranchi Off-campus Training Programme, on "ICT and Mass Media in Agricultural Extension" in collaboration with MANAGE, Hyderabad from May 04-08, 2021.
122. Gaur Sunder, "Digital Health Landscape in India", Webinar on 'Standardization in Health Informatics - Opportunities & Challenges', Virtual, March 11, 2021.
123. Manisha Mantri and Pranouti Patil, "Overview of FHIR Implementation Guide for ABDM", Fast Healthcare Interoperability Resources (FHIR) India Meetup 2021, Virtual, April 24, 2021.
124. Achyut Patil, "Standards on MDDS for Health Domain (from the perspective of the current trends)", Awareness workshop on e-Governance Standards & Guidelines, Virtual, August 13, 2021.
125. Manisha Mantri, "Panel Discussion on Interoperability-Achieving a Connected Healthcare Eco System", HIMSSIndia21 HIMSS India Annual Conference, Virtual, September 17, 2021.
126. Gaur Sunder, "Healthcare Technology and Innovations", Webinar on 'Changes call for innovation, and innovation leads to progress', Virtual, September 23, 2021.
127. Manisha Mantri, "Digital Health Policies and Initiatives in India', The Healthcare Innovation Challenge (HIC2) 2nd Edition Finale, Virtual, September 30, 2021.
128. Manisha Mantri and Suresh Sharma, "Digital Equity for All Ages: Nurses Role", International Day for Older Persons, Virtual, October 05, 2021.
129. Manisha Mantri, "Standards applicable to Telemedicine", SGPGI O1/02 Course Module: Telemedicine: Part I, Basics, Virtual, October 20, 2021.
130. Pranouti Patil and Ritika Jain, "Introduction to ABDM and FHIR Implementation Guide for ABDM", SNOMED CT Expo 2021", Virtual, November 17, 2021.
131. Manisha Mantri, "Applying Data Science Techniques in Healthcare", Tech Talk at BITS Pilani, Virtual, December 15, 2021.
132. Shailendra Singh Narwariya, "Adoption of emerging technologies for Acute Care and Incentive Care settings", TELEMEDICON2021, 17th Annual International Conference of Telemedicine Society of India,

Virtual, November 14, 2021.

133. Shailendra Singh Narwariya, "ICT inclusion for Smart City", Sustainable Smart Cities & Green Energy (NCSSCGN-21), Sagar Institute of Science, Technology & Research Bhopal in the association of RGPV Bhopal, Smart City Corporation & D K Electro-Mech Corporation, Bhopal, Virtual, September 25, 2021.
134. Lijo Thomas, "IETF Contribution Through Collaborative Research Project on IIOT", Short training program conducted by GTU-Graduate School of Engineering and Technology, Ahmadabad, Online, December 29, 2021.
135. Anish Sathyan, "Advanced Real-Time Operating System Techniques for Embedded Devices", Expert Talk, Govt. Engineering College, Idukki, September 24, 2021.
136. Benoygopal E B, "oneM2M Testing and CoSMiC common service layer", Telecommunications Standards Development Society, India (TSDSI), Virtual, December 7, 2021.
137. George Thomas, "Implementation of Fleet Management System for Transportation of Food Grains based National Food Safety Act", Workshop on Strengthening Public Distribution System in Kerala through E-Governance, Organized by Food & Civil Supplies Department, Kerala, Trivandrum, November 30, 2021.
138. Dija S., "Cyber Forensics: New Areas and Challenges", IEEE INDICOMM Conference 2021, IEEE Kerala Section, October 10, 2021.
139. Nabeel Koya A, "Digital Forensics", 2nd International Conference on Information Security and Computer Technology (ICICSCT 2021), University of Technology Mara, (UiTM MARA), Malaysia, July 24, 2021.
140. Dr. Dittin Andrews, "Getting to Know Your enemy and Yourself from Cyber Security Perspective", National Cyber Security Awareness Month Celebrations, KSEB Thiruvananthapuram, October 26, 2021.
141. Senthilkumar K B, "Security Operation Centre (SOC) Challenges – Is ML the panacea?", One Week Online Faculty Development Programme on Cyber Security using ML-Practical Applications, Dr. MGR University, Chennai, January 5, 2021.
142. Senthilkumar K B, "General introduction to cyber security", 2nd International Conference on Information Security and Computer Technology (ICICSCT 2021), University of Technology Mara, (UiTM MARA), Malaysia, July 24, 2021.
143. Harikrishnan CS, "Underwater Drone-Technology & Development", Training programme on UAVs, Online, Organised by C-DAC Mohali in association with TiHAN foundation, IIT Hyderabad, November 11, 2021.
144. Rajesh R, "Embedded System", FDP, Online, Organized by Govt. HSS, Vechoochira, March 11, 2021.
145. Binu P J, "Smart Healthcare with Telemedicine, EMR and Biomedical Systems", IEEE EMBS Kerala Chapter Distinguished Lecture, Trivandrum, March 5, 2021.
146. Balan C., "Mobile Forensics: Key to every Digital Forensic Investigations", BRICS workshop, Online, August 4, 2021.
147. Dr. Priya P Sajan, "Social Networking and Fake messages", Cyber Security for Child's Safety, Swadeshi Science Movement, October 9, 2021.
148. Dr. Priya P Sajan, "Cyber-crimes & Forensic Investigation", Information Security Education and Awareness (ISEA), Andhra University College of Engineering, December 20, 2021.
149. Dr. Priya P Sajan, "Data Protection & Security", Information Security Education and Awareness (ISEA), Government Vocational Higher Secondary School (GVHSS) Vayala, Kottayam, January 22, 2022.
150. Sreedeep A L, "Cyber Crimes and Information Security", Information Security Education and Awareness (ISEA), Swadeshi Science Movement, Kottayam, November 13, 2021.
151. Anupama P, "Non-invasive Sensor technology in Healthcare Applications", AICTE Training and Learning (ATAL) Academy FDP conducted by ER&DCI, Online, November 25, 2022.
152. Sureshkumar M.S., "Digital Communication Standards", Expert talk, Kerala Police Training College, August 27, 2021.
153. S Krishnakumar Rao, "VEGA Processor and Ecosystem", IESA Webinar, Online (Webex), January 28, 2022.
154. S Krishnakumar Rao, "Microprocessor Development Programme-VEGA Processors, Azadi Ka Digital Mahotsav", India Habitat Centre, New Delhi, December 3, 2021.
155. V. Chandrasekar, "Electric Vehicle Supply Equipment for Public metered outlets", National Power Electronics Conference (NPEC), IIT, Bhubaneswar, December 17, 2021.

# Human Resource Development

Traditionally, C-DAC HR was more focused on employment administration, but recently HR has been positively reframed and covers a much wider remit, with an enhanced focus on HR development and engagement.

In C-DAC, HR plays a significant role in developing a positive organisational culture and improving employee engagement and productivity. HR is also taking lead on employee wellness and personal development initiatives.

## Accomplishments and Initiatives during the year 2021 – 22

1. **Revised Modified Engagement Model for Technical staff (PA/ PE/KA /(PL /ML/ SPE)/PM/KP):** This initiative is derived with the philosophy that same qualification and years of experience does not bring the same value or competency and therefore not the same pay/role positioning.
   Modified Engagement Model (MEM) for technical staff on contact on consolidated pay was diligently deliberated and implemented successfully.

2. **Exit Interview and Assessment:** This intervention was initiated with the goal of determining structured ways and means to retain the trained and skilled workforce and to foster positive relationships in order to improve C-DAC's work culture. It is successfully implemented and executed across C-DAC uniformly.

3. **BrainVita (Virtual Quiz):** As a part of employee engagement activities, a pan C-DAC quiz - BrainVita is being conducted by Corporate HRD, wherein a large number of employees participated enthusiastically. [[

4. **Centralised Training:** Centralised training consist of small modules and structural courses on soft skills, technical and Non-technical topics. Imparted 3785 man-days of training during the year. Which is in addition to the centre level project specific trainings.

5. **Meet the Master & Leader Speak:** Introduced Meet the Masters and Leaders Speak in the Knowledge Assimilation in Pieces (KAP) Portal, which carries motivational & domain-specific talks by eminent personalities. A total of 24 talks are placed for employee to access any time.

6. **C-DAC Accelerated Knowledge Enhancement Series (CAKEs):** Through this e-learning platform 1671 man-days of training delivered under controlled environment. The learnings are accessed for each such modules.

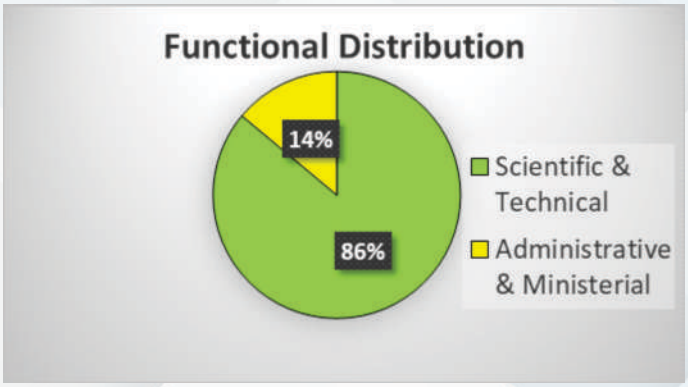
7. **Leadership Coaching:** Conducted an Assessment Centre for select leaders for identifying competency levels on the agreed list of competencies. 2-3 competencies per participant were agreed upon and personal coaching was imparted by renowned leadership coaches.

8. **C-DAC paid internship scheme:** C-DAC paid Internship scheme was notified with the objective to allow young talent from top 50 institutes (NIRF ranking) to be associated with C-DAC from the R&D perspective and promote innovation in the projects undertaken. 32 students were inducted for internship for a duration of 6 months/1 year, in 2021-22. This scheme is getting more and more popular based on the effectiveness.

## Manpower Distribution

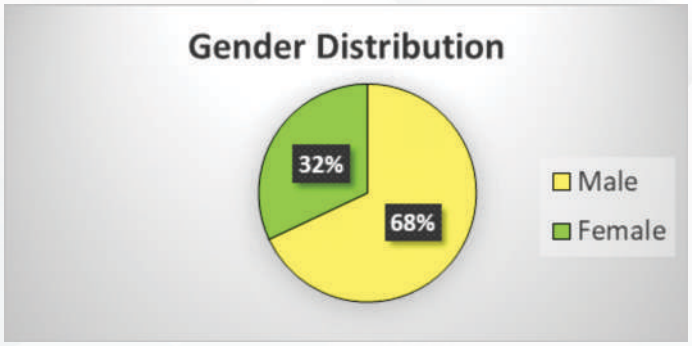
### Functional Distribution :

C-DAC has 3139 employees as on March 2022, spread across 12 centres and Corporate Office. The functional composition of the workforce is as shown below:

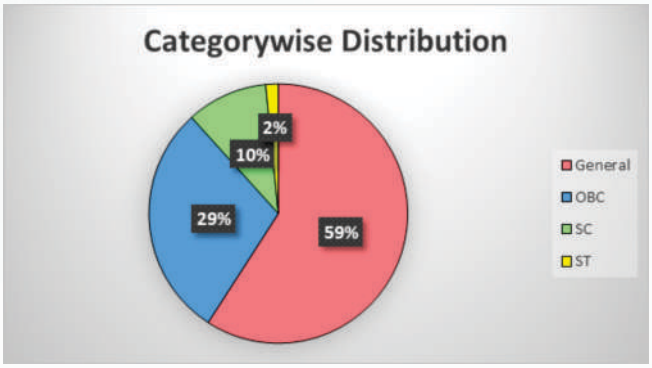



**Gender Distribution :**

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.

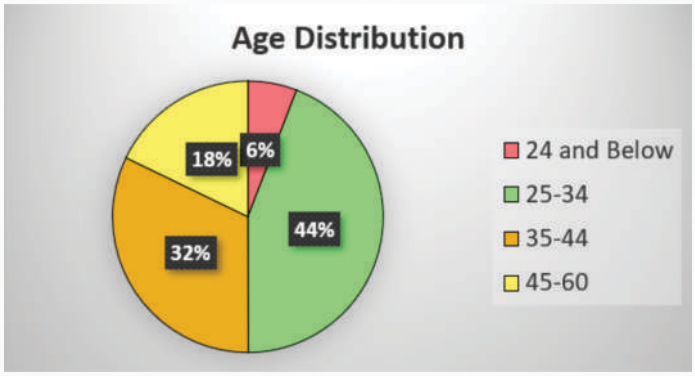



**Category Distribution** – As a law-abiding model employer, C-DAC has ensured adequate representation of Scheduled Caste (SC), Scheduled Tribes (ST) and OBC members. C-DAC obliges the national priority in fair terms and has significant representation of the reserved categories. It is pertinent to note 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. 50 percent of the employees are below the age of 35 years and has an average age of 35.2 years.



# Legal

The Legal Department renders proactive legal services to the Organisation in all legal matters such as prosecution of cases in Courts, litigation management, documentation preparation, drafting, vetting, providing legal advice and guidance.

The Legal Department has drafted/vetted 268 MOUs/Agreements/NDA/RFP/EOI etc.

In addition to the above, the Legal Department coordinates with MeitY and the Centres for the court cases, attends hearings and conferences to brief appearing counsels.

The Department also advises in the matter of preferring of appeals in the various Courts and Tribunals as well as taking recourse to other legal remedies.

A Centralized Repository System for all legal cases of C-DAC has been successfully implemented which was envisioned to bring in consistency in the stand taken by C-DAC in all similar cases handled by different centres of C-DAC.

## 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 2021, total 462 applications were received which were duly processed.

## Vigilance matters taken up during the year 2021-22

Total 05 complaints have been received in this year. One complaint was pending of last year. All six complaints have bene disposed off and factual reports have been submitted to Chief Vigilance Officer. These complaints were mainly related to misconduct and tender. At present, there is no complaint under investigation, details of complaints received in Vigilance related is enclosed.

### Vigilance Operations and Functions

As per the guidelines of the Central Vigilance Commission, Vigilance Awareness Week was observed in all C–DAC centres during 26th October 2021 – 01st November 2021. The observance of Vigilance Awareness Week commenced in all centres on 26th October 2021 with the 770 employees, 250 customers and 458 citizens taking the integrity pledge with the theme of "Independent India @75: Self Reliance with Integrity" 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 with overwhelming response by essay writing, On-line quizzes, Short video, Poster competition, Drawing competition, Slogan competition, various seminars/workshops. The some photographs of the centre are enclosed.

In Noida centre, an online lecture was conducted on 26th October 2021 on "Constitutional Protection for Govt. Servant" by Shri Mukesh Chaturvedi, Director (DoPT) Retired, for the employee of C-DAC, Noida.

In Thiruvanthapraum centre, a talk on the theme "Complaints under PIDPI (Public Interest Disclosure and Protection of Informers) and Redressal Mechanism was organized over Video Conferencing on 27th October 2021 by Smt. Arti Chhabra Srivastava, Chief Vigilance Officer, Securities and exchange Board of India (SEBI), Govt. of India with Senior Director Shri Titus A Chazhoor presiding over the function.

To know proper process/procedure are being followed in C-DAC centres, a surprise checking visit was scheduled in the selected centres and detailed reported was obtained from the respective Assistant Vigilance Officer nominated for this surprise visit. C-DAC, CVO has taken note of that and broadly agreed with the process being followed in C-DAC centres.

# Financials

LAHOTI KASAT & CO.
CHARTERED ACCOUNTANTS

**Head Office :** 204, 2nd floor, P.J. Chambers, Pimpri, Pune - 411 018.

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

Ref. Date :

## INDEPENDENT AUDITOR'S REPORT

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

### Report on the Consolidated Financial Statements

### Opinion

We have audited the accompanying ConsolidatedFinancial 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, 2022 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 consolidatedfinancial statements") in which are incorporated the accounts for the year endedon 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, Silchar and Thiruvananthapuram).

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid consolidatedfinancial 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, 2022, and its consolidatedsurplus and its consolidatedreceipts and payments for the year ended on that date.

### Basis for Opinion

We conducted audit in accordance with standards on auditing issued by institute ofChartered Accountants of India. Our responsibilities under thoseStandardsare further described in the Auditor's Responsibilities for the Audit of the ConsolidatedFinancial 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 theconsolidated 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 consolidatedfinancial statements.

## Management's Responsibility for the Financial Statements

The Center's management is responsible for the preparation of theseconsolidatedfinancial statements that give a true and fair view of the consolidatedfinancial position, consolidatedfinancial performance and consolidatedreceipts 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 consolidatedfinancial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

In preparing the consolidatedfinancial statements, the management of the Centre's of C-DACis 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 inthe aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidatedfinancial 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 consolidatedfinancial 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 consolidatedfinancial 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 consolidatedfinancial statements represent the underlying transactions and events in a manner that achieves fair presentation.

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

Materiality is the magnitude of misstatements in the consolidatedfinancial 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 consolidatedfinancial 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 themall 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 separatefinancial statements, referred in the other Matters paragraph above we report, to theextent 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 consolidatedfinancial statements

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

c. The ConsolidatedBalance sheet, the ConsolidatedIncome and Expenditure Account and ConsolidatedReceipts 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 consolidatedfinancial 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 :22151410ATZRGU6970**
**Place: Pune**
**Date: 22nd September,2022.**

## CONSOLIDATED BALANCE SHEET AS AT 31st March 2022

*Amount in ₹*

| Particulars | Schedule | 2021-22 | 2020-21 |
|---|---|---|---|
| **CORPUS/CAPITAL FUND AND LIABILITIES** | | | |
| Corpus/Capital Fund | 1 | 5,85,87,96,883 | 4,38,36,31,364 |
| Reserves and Surplus | 2 | 3,80,01,86,315 | 3,12,87,42,898 |
| Earmarked and Endowment Funds | 3 | 10,87,64,25,880 | 9,19,99,18,791 |
| Secured Loan from Bank | | - | - |
| Current Liabilities and Provisions | 4 | 4,58,22,80,021 | 4,87,97,16,596 |
| Branch & Divisions | | - | - |
| **Total** | | **25,11,76,89,099** | **21,59,20,09,649** |
| **ASSETS** | | | |
| **Fixed Assets** | | | |
| Acquired out of Own Funds | 5 | 39,49,36,323 | 36,46,97,358 |
| Acquired out of Grant in Aid | 6 | 1,91,71,59,761 | 1,89,80,02,108 |
| Acquired out of Project Grants | 7 | 1,88,30,26,555 | 1,23,07,40,791 |
| Investments-Others | | 5,05,000 | 5,05,000 |
| Current Assets, Loans & Advances | 8 | 20,92,20,61,460 | 18,09,80,64,392 |
| Miscellaneous Expenditure | | - | - |
| **Total** | | **25,11,76,89,099** | **21,59,20,09,649** |
| | | - | - |
| Summary of significant accounting policies | 17 | | |
| See accompanying notes forming part of financial statements | 18 | | |

**Indira Pasupathy**
**Director Finance**

**Sunil Misar**
**Registrar (I/C)**

**Magesh Ethirajan**
**Director General**

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 : 22151410ATZRGU6970**
**Place : Pune , Date : 22-Sept.-2022**

## CONSOLIDATED INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st March 2022

*Amount in ₹*

| Particulars | Schedule | 2021-22 | 2020-21 |
|---|---|---|---|
| **INCOME** | | | |
| Income from Sales/Services | 9 | 4,60,34,44,305 | 3,14,64,04,580 |
| Grants/Subsidies | 10 | 2,14,25,68,231 | 1,33,44,52,138 |
| Fees/Subscription | 11 | 92,99,70,167 | 20,48,36,390 |
| Interest Earned | 12 | 28,14,35,204 | 28,99,48,114 |
| Other Income | 13 | 1,34,67,104 | 1,53,71,951 |
| Prior Period Income | | 1,58,98,581 | 4,76,189 |
| Increase/(decrease) in stock of Finished Goods and Work-in-progress | 14 | (42,04,74,615) | (12,11,49,974) |
| **TOTAL (A)** | | **7,56,63,08,977** | **4,87,03,39,388** |
| **EXPENDITURE** | | | |
| Establishment Expenses | 15 | 3,57,92,65,157 | 2,83,75,69,662 |
| Other Administrative Expenses | 16 | 2,28,04,80,015 | 1,38,38,66,537 |
| Prior Period Expenses | | 17,29,79,614 | (6,55,88,863) |
| Depreciation (corresponding to Schedule 5) | | 6,16,33,473 | 5,12,68,531 |
| **TOTAL (B)** | | **6,09,43,58,259** | **4,20,71,15,867** |
| Transferred to / (from) Balance of Mission Grants | | (32,15,067) | 7,21,35,651 |
| **BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CORPUS/CAPITAL FUND** | | **1,47,51,65,785** | **59,10,87,870** |
| Summary of significant accounting policies | 17 | | |
| See accompanying notes forming part of financial statements | 18 | | |

**Indira Pasupathy**
**Director Finance**

**Sunil Misar**
**Registrar (I/C)**

**Magesh Ethirajan**
**Director General**

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 : 22151410ATZRGU6970**
**Place : Pune , Date : 22-Sept.-2022**

*Amount in ₹*

| Particulars | 2021-22 | 2020-21 |
|---|---|---|
| **Schedule 1 - Corpus/Capital Fund** | | |
| **Balance as at the beginning of the year** | 4,38,36,31,363 | 3,79,25,43,493 |
| **Add:** Surplus as per Income & Expenditure Account | 1,47,51,65,785 | 59,10,87,870 |
| **Less :** Own contribution to Core / Projects and Other Adjustments / Transfers | 265 | - |
| **Less :** Corporate Office Contribution | - | - |
| **Balance as at the year - end** | **5,85,87,96,883** | **4,38,36,31,363** |
| **Schedule 2 - Reserves and Surplus** | | |
| **1. Capital Reserve :** | | |
| As per last Account | 3,12,87,42,898 | 2,55,92,70,364 |
| Addition during the year | 1,77,79,51,702 | 1,19,85,89,777 |
| Less : Deductions during the year | 1,10,65,08,285 | 62,91,17,243 |
| **Total** | **3,80,01,86,315** | **3,12,87,42,898** |
| **Schedule 3 - Earmarked/Endowment Funds** | | |
| **1. Balance of Core Grants** | | |
| **a) Opening balance of the funds** | 6,82,25,871 | - |
| **b) Additions to the Funds** | | |
| I) Donations/Grants | 2,17,00,00,000 | 1,25,00,00,000 |
| II) Income from Investments made on account of funds | - | - |
| III) Other additions (C-DAC Contribution and Other Income) | 7,52,85,546 | 9,96,31,655 |
| Total (b) | 2,24,52,85,546 | 1,34,96,31,655 |
| **Total (a)+(b)** | 2,31,35,11,417 | 1,34,96,31,655 |
| **c) Utilization/Expenditure towards objectives of funds** | | |
| I) Capital Expenditure | | |
| Fixed Assets | 10,25,90,624 | 1,52,70,186 |
| Others | - | - |
| **Total I** | 10,25,90,624 | 1,52,70,186 |
| II) Revenue Expenditure | | |
| Salaries, Wages and Allowances etc. | 1,77,27,61,372 | 1,21,12,72,375 |
| Componants, Consumables and Other Direct Expenses | 75,42,058 | 19,17,964 |
| Travel | 67,08,969 | 20,92,890 |
| Contingencies, Overheads and Other Administrative Expenditure | 35,88,97,589 | 5,08,52,369 |
| **Total II** | 2,14,59,09,988 | 1,26,61,35,597 |
| **Total ( c )** | 2,24,85,00,612 | 1,28,14,05,783 |
| **Net Balance as at Year - End (a+b-c) Total 1** | 6,50,10,805 | 6,82,25,872 |
| **Projects wise Allocated Core Grant Projects (Details as per Annexure 1)** | | |
| **d) Opening balance** | (17,57,89,128) | (21,88,62,920) |
| **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 | 6,24,48,360 | 2,30,73,792 |
| Total (e) | 6,24,48,360 | 4,30,73,792 |
| **Total (d)+(e)** | (11,33,40,768) | (17,57,89,128) |

*Amount in ₹*

| Particulars | 2021-22 | 2020-21 |
|---|---|---|
| **f) Utilization/Expenditure towards objectives of** | | |
| I) Capital Expenditure | | |
| Fixed Assets | 3,09,24,265 | - |
| Others | - | - |
| **Total I** | 3,09,24,265 | - |
| 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 )** | 3,09,24,265 | - |
| **g) Refund / Transfer and Other Adjustments** | - | - |
| **Net Balance as at Year - End (d+e-f-g) Total 2** | (14,42,65,033) | (17,57,89,128) |
| **Core Grant Balance as at Year - End (Total 1 + Total 2) Total 3** | (7,92,54,228) | (10,75,63,256) |
| **2. Grants for Funded Projects (Details as per Annexure 2)** | | |
| **a) Opening balance of the funds** | 9,30,14,79,147 | 8,13,15,25,553 |
| **b) Additions to the Funds** | | |
| I) Donations/Grants | 7,15,44,31,389 | 5,69,43,63,226 |
| II) Income from Investments made on account of funds | 35,75,89,003 | 37,62,96,282 |
| III) Other additions (C-DAC Contribution and Other Income) | 14,84,30,290 | 15,58,41,524 |
| Total (b) | 7,66,04,50,682 | 6,22,65,01,032 |
| **Total (a)+(b)** | 16,96,19,29,829 | 14,35,80,26,585 |
| **c) Utilization/Expenditure towards objectives of funds** | | |
| I) Capital Expenditure | | |
| Fixed Assets | 1,64,47,20,651 | 1,18,83,33,508 |
| Others | - | - |
| **Total I** | 1,64,47,20,651 | 1,18,83,33,508 |
| II) Revenue Expenditure | | |
| Salaries, Wages and Allowances etc. | 1,34,94,11,368 | 1,18,33,87,898 |
| Componants, Consumables and Other Direct Expenses | 1,34,52,63,046 | 1,88,81,15,857 |
| Travel | 4,53,95,316 | 2,00,31,084 |
| Contingencies, Overheads and Other Administrative Expenditure | 93,47,49,399 | 46,05,78,430 |
| **Total II** | 3,67,48,19,129 | 3,55,21,13,269 |
| **Total ( c )** | 5,31,95,39,780 | 4,74,04,46,777 |
| **d) Refund / Transfer and Other Adjustments** | 69,36,75,358 | 31,61,00,662 |
| **Net Balance as at Year - End (a+b-c-d) Total 4** | 10,94,87,14,691 | 9,30,14,79,146 |
| **3. Employee and Other Funds:** | | |
| As per last Account | 60,02,901 | 58,52,587 |
| Addition during the year | 9,62,516 | 1,50,315 |
| Less : Deductions during the year | - | - |
| **Total 5** | 69,65,417 | 60,02,902 |
| **Grand Total (Total 3+ Total 4+Total 5)** | **10,87,64,25,880** | **9,19,99,18,791** |

**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 | (17,57,89,128) | - | - | 6,24,48,360 | 3,09,24,265 | - | - | - | - | 3,09,24,265 | - | (14,42,65,033) |
| 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | **Total** | **(17,57,89,128)** | **-** | **-** | **6,24,48,360** | **3,09,24,265** | **-** | **-** | **-** | **-** | **3,09,24,265** | **-** | **(14,42,65,033)** |

**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 | 9,13,77,593 | 43,05,30,697 | 20,82,737 | - | 1,46,25,208 | 5,54,13,616 | 73,88,993 | 22,48,234 | 40,14,95,513 | 48,11,71,564 | 1,24,53,434 | 3,03,66,029 |
| | Other Agency Projects | 2,81,90,369 | 87,56,000 | 4,75,901 | - | 7,02,663 | 11,70,819 | 2,05,77,139 | - | 63,900 | 2,25,14,521 | 3,11,526 | 1,45,96,223 |
| | Total Bangalore Centre | 11,95,67,962 | 43,92,86,697 | 25,58,638 | - | 1,53,27,871 | 5,65,84,435 | 2,79,66,132 | 22,48,234 | 40,15,59,413 | 50,36,86,085 | 1,27,64,960 | 4,49,62,252 |
| 2 | **Chennai Centre** | | | | | | | | | | | | |
| | MeitY Projects | 29,352 | 1,53,43,000 | - | - | 15,07,353 | 1,03,37,097 | 17,35,766 | 3,17,228 | 13,22,882 | 1,52,20,326 | 17,98,026 | (16,46,000) |
| | Other Agency Projects | - | - | - | - | - | - | - | - | - | - | - | - |
| | Total Chennai Centre | 29,352 | 1,53,43,000 | - | - | 15,07,353 | 1,03,37,097 | 17,35,766 | 3,17,228 | 13,22,882 | 1,52,20,326 | 17,98,026 | (16,46,000) |
| 3 | **Corporate Office** | | | | | | | | | | | | |
| | MeitY Projects | - | - | - | - | - | - | - | - | - | - | - | - |
| | Other Agency Projects | - | - | - | - | - | - | - | - | - | - | - | - |
| | Total Corporate Office | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | **Delhi Centre** | | | | | | | | | | | | |
| | MeitY Projects | 1,47,85,323 | 1,70,93,000 | 64,970 | - | - | 1,42,35,264 | 51,59,032 | 4,67,336 | 31,72,619 | 2,30,34,251 | 58,68,981 | 30,40,061 |
| | Other Agency Projects | 18,29,75,142 | 4,25,29,242 | 6,094 | - | - | 3,24,38,893 | 6,86,65,824 | 62,165 | 5,45,406 | 10,17,12,288 | 38,851 | 12,37,59,339 |
| | Total Delhi Centre | 19,77,60,465 | 5,96,22,242 | 71,064 | - | - | 4,66,74,157 | 7,38,24,856 | 5,29,501 | 37,18,025 | 12,47,46,539 | 59,07,832 | 12,67,99,400 |
| 5 | **Hyderabad Centre** | | | | | | | | | | | | |
| | MeitY Projects | 31,03,34,918 | 2,34,21,703 | 1,12,74,009 | (11,77,000) | 3,33,85,168 | 8,74,08,000 | 1,21,49,461 | 37,75,408 | 1,29,03,975 | 14,96,22,012 | 2,91,64,356 | 16,50,67,264 |
| | Other Agency Projects | 10,54,25,603 | 5,30,49,413 | 36,02,000 | - | 3,45,21,768 | 3,93,80,578 | 47,55,752 | 26,91,727 | 87,96,336 | 9,01,46,161 | 63,49,757 | 6,55,81,098 |
| | Total Hyderabad Centre | 41,57,60,521 | 7,64,71,116 | 1,48,76,009 | (11,77,000) | 6,79,06,936 | 12,67,88,578 | 1,69,05,213 | 64,67,135 | 2,17,00,311 | 23,97,68,173 | 3,55,14,113 | 23,06,48,362 |
| 6 | **Kolkata Centre** | | | | | | | | | | | | |
| | MeitY Projects | 4,58,02,002 | 9,64,69,000 | 5,78,491 | (8,57,319) | 46,29,296 | 4,24,40,777 | 3,34,50,213 | 47,33,211 | 5,27,16,690 | 13,79,70,187 | 27,29,917 | 12,92,070 |
| | Other Agency Projects | 2,71,90,919 | 1,51,76,536 | 5,509 | - | 2,42,790 | 96,02,537 | 19,67,171 | 9,45,541 | 35,99,834 | 1,63,57,873 | 1,35,990 | 2,58,79,101 |
| | Total Kolkata Centre | 7,29,92,921 | 11,16,45,536 | 5,84,000 | (8,57,319) | 48,72,086 | 5,20,43,314 | 3,54,17,384 | 56,78,752 | 5,63,16,524 | 15,43,28,060 | 28,65,907 | 2,71,71,171 |
| 7 | **Mohali Centre** | | | | | | | | | | | | |
| | MeitY Projects | (1,70,659) | 21,30,28,000 | 2,29,361 | 45,80,855 | 69,23,438 | 2,31,51,964 | 66,77,035 | 3,52,958 | 25,67,050 | 3,96,72,445 | 9,80,77,769 | 7,99,17,343 |
| | Other Agency Projects | 6,90,39,702 | 66,57,98,500 | 1,16,56,132 | - | 1,70,56,034 | 6,43,63,262 | 1,20,11,898 | 2,06,758 | 3,27,56,184 | 12,63,94,136 | 39,54,490 | 61,61,45,708 |
| | Total Mohali Centre | 6,88,69,043 | 87,88,26,500 | 1,18,85,493 | 45,80,855 | 2,39,79,472 | 8,75,15,226 | 1,86,88,933 | 5,59,716 | 3,53,23,234 | 16,60,66,581 | 10,20,32,259 | 69,60,63,051 |
| 8 | **Mumbai Centre** | | | | | | | | | | | | |
| | MeitY Projects | 6,56,05,763 | 12,20,04,000 | 8,95,930 | 16,59,968 | 3,16,04,306 | 4,43,07,284 | 2,28,67,633 | 2,00,503 | 57,22,277 | 10,47,02,003 | 8,31,93,214 | 22,70,444 |
| | Other Agency Projects | (9,41,890) | - | - | 9,41,890 | - | - | - | - | - | - | - | - |
| | Total Mumbai Centre | 6,46,63,873 | 12,20,04,000 | 8,95,930 | 26,01,858 | 3,16,04,306 | 4,43,07,284 | 2,28,67,633 | 2,00,503 | 57,22,277 | 10,47,02,003 | 8,31,93,214 | 22,70,444 |
| 9 | **Noida Centre** | | | | | | | | | | | | |
| | MeitY Projects | 96,68,94,031 | 14,04,24,192 | 2,58,46,406 | 13,08,000 | 1,26,00,490 | 22,79,19,962 | 7,19,31,598 | 1,22,02,556 | 26,34,52,118 | 58,81,06,724 | 1,59,57,426 | 53,04,08,479 |
| | Other Agency Projects | 4,15,35,952 | 1,26,53,400 | 6,36,000 | - | 1,76,110 | 1,37,63,080 | 2,12,249 | 23,000 | 71,15,587 | 2,12,90,026 | - | 3,35,35,326 |
| | Total Noida Centre | 1,00,84,29,983 | 15,30,77,592 | 2,64,82,406 | 13,08,000 | 1,27,76,600 | 24,16,83,042 | 7,21,43,847 | 1,22,25,556 | 27,05,67,705 | 60,93,96,750 | 1,59,57,426 | 56,39,43,805 |
| 10 | **Patna Centre** | | | | | | | | | | | | |
| | MeitY Projects | - | - | - | - | - | - | - | - | - | - | - | - |
| | Other Agency Projects | 39,09,780 | - | - | - | - | 39,09,780 | - | - | - | 39,09,780 | - | - |
| | Total Patna Centre | 39,09,780 | - | - | - | - | 39,09,780 | - | - | - | 39,09,780 | - | - |
| 11 | **Pune Centre** | | | | | | | | | | | | |
| | MeitY Projects | 3,35,68,50,543 | 13,61,82,000 | 9,31,42,935 | 1,15,48,603 | 88,10,04,569 | 36,22,35,011 | 1,74,34,697 | 68,13,834 | 9,86,46,078 | 1,36,61,34,189 | 21,13,65,836 | 2,02,02,24,056 |
| | Other Agency Projects | 3,36,65,18,245 | 4,17,63,20,669 | 19,09,35,668 | 9,97,21,293 | 13,88,28,854 | 5,11,03,103 | 91,60,66,534 | 8,53,366 | 11,20,15,856 | 1,21,88,67,713 | 21,18,95,448 | 6,40,27,32,714 |
| | Total Pune Centre | 6,72,33,68,788 | 4,31,25,02,669 | 28,40,78,603 | 11,12,69,896 | 1,01,98,33,423 | 41,33,38,114 | 93,35,01,231 | 76,67,200 | 21,06,61,934 | 2,58,50,01,902 | 42,32,61,284 | 8,42,29,56,770 |
| 12 | **Silchar Centre** | | | | | | | | | | | | |
| | MeitY Projects | - | - | - | - | - | - | - | - | - | - | - | - |
| | Other Agency Projects | - | - | - | - | - | - | - | - | - | - | - | - |
| | Total Silchar Centre | - | - | - | - | - | - | - | - | - | - | - | - |
| 13 | **Thiruvananthapuram Centre** | | | | | | | | | | | | |
| | MeitY Projects | 60,91,31,191 | 96,23,18,000 | 1,55,11,674 | 2,74,04,000 | 46,61,29,882 | 25,55,91,125 | 13,54,62,353 | 86,62,365 | (8,34,01,013) | 78,24,44,712 | 99,97,193 | 82,19,22,960 |
| | Other Agency Projects | 1,69,95,266 | 2,33,34,037 | 6,45,186 | 33,00,000 | 7,82,722 | 1,06,39,216 | 67,49,698 | 8,39,126 | 1,12,58,107 | 3,02,68,869 | 3,83,144 | 1,36,22,476 |
| | Total Thiruvananthapuram Centre | 62,61,26,457 | 98,56,52,037 | 1,61,56,860 | 3,07,04,000 | 46,69,12,604 | 26,62,30,341 | 14,22,12,051 | 95,01,491 | (7,21,42,906) | 81,27,13,581 | 1,03,80,337 | 83,55,45,436 |
| | | | | | | | | | | | | | |
| | **Total MeitY Projects** | **5,46,06,40,058** | **2,15,68,13,592** | **14,96,26,513** | **4,44,67,107** | **1,45,24,09,710** | **1,12,30,40,100** | **31,42,56,781** | **3,97,73,633** | **75,85,98,189** | **3,68,80,78,413** | **47,06,06,152** | **3,65,28,62,706** |
| | **Total Other Agency Projects** | **3,84,08,39,089** | **4,99,76,17,797** | **20,79,62,490** | **10,39,63,183** | **19,23,10,941** | **22,63,71,268** | **1,03,10,06,265** | **56,21,683** | **17,61,51,210** | **1,63,14,61,367** | **22,30,69,206** | **7,29,58,51,985** |
| | | | | | | | | | | | | | |
| | **Grand Total** | **9,30,14,79,147** | **7,15,44,31,389** | **35,75,89,003** | **14,84,30,290** | **1,64,47,20,651** | **1,34,94,11,368** | **1,34,52,63,046** | **4,53,95,316** | **93,47,49,399** | **5,31,95,39,780** | **69,36,75,358** | **10,94,87,14,691** |

*Amount in ₹*

| Particulars | 2021-22 | 2020-21 |
|---|---|---|
| **Schedule 4 - Current Liabilities and Provisions** | | |
| **A. Current Liabilities** | | |
| **1. Trade Payables (For Goods and Others)** | 90,39,25,281 | 1,15,43,97,264 |
| **2. Advances Received** | | |
| a) Advances Received from Parties | 1,96,57,88,593 | 2,35,01,81,230 |
| b) Fees Received in Advance | 12,000 | 12,000 |
| c) AMC Charges Received in Advance | 27,88,000 | - |
| d) Other Income Received in Advance | 18,57,89,039 | 18,66,51,965 |
| **3. Statutory Liabilities** | | |
| a) Members CPF Recovery Payable | 2,15,41,438 | 1,92,03,773 |
| b) Members VPF Payable | 27,30,477 | 26,75,341 |
| c) Members CPF Loan Recovery Payable | 3,311 | 61,165 |
| d) Members Benevolent Fund Payable | 7,24,513 | 8,31,124 |
| e) Members CGEIS/Group Insurance Payable | 1,11,049 | 65,508 |
| f) Members Other Recoveries Payable | 12,48,440 | 8,23,511 |
| g) C-DAC's Contribution to CPF Payable | 2,62,77,820 | 2,29,32,905 |
| h) Gratuity Payable | 17,45,23,773 | 11,41,87,059 |
| i) Leave Salary and Pension Contribution Payable | 45,24,60,822 | 33,98,04,125 |
| j) Members Income Tax Payable | 4,40,09,013 | 3,27,74,461 |
| k) Tax Deducted at Source Payable | 4,91,34,765 | 1,17,68,172 |
| l) Profession Tax Payable | 3,11,212 | 3,14,828 |
| m) Service Tax Payable | - | - |
| n) CGST Payable | 3,00,55,269 | 60,63,888 |
| o) SGST Payable | 2,16,21,671 | 80,36,975 |
| p) IGST Payable | 20,43,12,767 | 11,02,20,672 |
| q) UTGST Payable | - | - |
| r) Reverse charge GST Payable | (12,297) | (2,65,293) |
| **4. Other Current Liabilities** | | |
| a) Unpaid Salaries | 2,42,63,353 | 1,42,06,419 |
| b) Library Deposits Payable | 95,850 | 85,950 |
| c) Other Security Deposits Payable | 4,60,77,845 | 4,05,76,283 |
| d) Earnest Money Deposit Contractors Payable | 98,56,601 | 3,83,85,816 |
| e) Retention Deposit Contractors | 1,01,20,329 | 99,19,607 |
| f) Refund of Course Fees Due | 16,42,015 | 16,15,512 |
| g) ATC's & Others Share in Fees Payable | 94,726 | 94,726 |
| h) Other Current Liabilities | 8,32,67,606 | 8,95,16,532 |
| **Total (A)** | 4,26,27,75,281 | 4,55,51,41,518 |
| **B. Provisions** | | |
| **1. Others (Specify)** | | |
| a) Provisions / Accrued Liabilities for Expenses | 31,95,04,740 | 32,45,75,078 |
| **Total (B)** | 31,95,04,740 | 32,45,75,078 |
| **Total (A)+(B)** | **4,58,22,80,021** | **4,87,97,16,596** |

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

*Amount in ₹*

| | | Gross Block | | | | | | Depreciation | | | | | Net Block | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sr. No. | Particulars | Cost/Valuation as on beginning of the year | Additions During the Year | | | Deletion/ Adjustments During the Year | Cost/Valuation as on end of the year | Depreciation as at beginning of the year | Depreciation Written Back | Depreciation Rate | Depreciation for Current Year | Total Depreciation up to the year end | WDV (Closing) | WDV (Opening) |
| | | | On or Before 30th September | After 30th September | Total Additions during the year | | | | | | | | | |
| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| 1 | Land | | | | | | | | | | | | | |
| | a) Freehold | 3,21,67,475 | - | - | - | - | 3,21,67,475 | - | - | 0% | - | - | 3,21,67,475 | 3,21,67,475 |
| | b) Leasehold | 17,21,96,623 | - | - | - | - | 17,21,96,623 | 2,16,17,383 | - | 0% | 6,97,292 | 2,23,14,675 | 14,98,81,948 | 15,05,79,240 |
| 2 | Building | | | | | | | | | | | | | |
| | a) On Freehold Land | 91,18,277 | - | - | - | - | 91,18,277 | 60,96,298 | - | 10% | 3,02,198 | 63,98,496 | 27,19,781 | 30,21,979 |
| | b) On Leasehold Land | 10,89,53,874 | - | - | - | - | 10,89,53,874 | 9,01,49,399 | - | 10% | 18,80,448 | 9,20,29,847 | 1,69,24,027 | 1,88,04,475 |
| | c) Ownership Flats/Premises | 3,97,26,295 | - | - | - | - | 3,97,26,295 | 3,38,67,610 | - | 10% | 5,85,869 | 3,44,53,479 | 52,72,816 | 58,58,685 |
| | d) Superstructures on Land not belonging to the entity | 1,34,26,841 | - | - | - | - | 1,34,26,841 | 1,23,83,616 | - | 10% | 1,04,322 | 1,24,87,938 | 9,38,903 | 10,43,225 |
| 3 | Plant, Machinery and Equipments | 6,74,57,262 | 1,74,652 | - | 1,74,652 | - | 6,76,31,914 | 5,30,26,549 | - | 15% | 21,90,805 | 5,52,17,354 | 1,24,14,560 | 1,44,30,713 |
| 4 | Vehicles | 2,18,14,668 | 8,01,080 | 8,61,498 | 16,62,578 | - | 2,34,77,246 | 1,26,84,519 | - | 15% | 16,18,910 | 1,43,03,429 | 91,73,817 | 91,30,149 |
| 5 | Furniture & Fixtures | 9,96,49,842 | 14,17,006 | 18,96,933 | 33,13,939 | - | 10,29,63,781 | 7,56,12,669 | - | 10% | 27,35,111 | 7,83,47,780 | 2,46,16,000 | 2,40,37,173 |
| 6 | Office Equipments | 4,81,56,885 | 5,17,041 | 19,62,329 | 24,79,370 | 2,10,939 | 5,04,25,316 | 3,25,41,677 | 1,39,589 | 15% | 27,03,483 | 3,51,05,571 | 1,53,19,745 | 1,56,15,208 |
| 7 | Air Conditioning Equipments | 3,55,01,316 | 3,62,079 | 71,79,347 | 75,41,426 | 36,93,160 | 3,93,49,582 | 2,99,50,349 | 34,08,253 | 15% | 19,21,124 | 2,84,63,220 | 1,08,86,361 | 55,50,966 |
| 8 | Computer Peripherals | 39,75,97,543 | 2,88,90,557 | 2,72,01,267 | 5,60,91,824 | 40,266 | 45,36,49,101 | 34,85,16,036 | 37,589 | 40% | 4,20,68,259 | 39,05,46,706 | 6,31,02,394 | 4,90,81,507 |
| 9 | Electrical Installations | 6,90,26,966 | 25,90,432 | 60,00,276 | 85,90,708 | 720 | 7,76,16,954 | 4,95,47,028 | 295 | 10% | 28,07,024 | 5,23,53,757 | 2,52,63,196 | 1,94,79,936 |
| 10 | Electronic Tools & Lab Equipments | 1,45,94,415 | 21,76,864 | - | 21,76,864 | - | 1,67,71,279 | 79,88,075 | - | 15% | 13,17,481 | 93,05,556 | 74,65,723 | 66,06,340 |
| 11 | Library Books | 1,55,57,837 | 48,797 | 1,94,276 | 2,43,073 | 18,765 | 1,57,82,145 | 1,53,82,244 | 6,362 | 40% | 1,62,507 | 1,55,38,389 | 2,43,756 | 1,75,593 |
| 12 | Copyright Know-how | 66,950 | - | - | - | - | 66,950 | 66,064 | - | 25% | 222 | -<br>66,286 | 664 | 886 |
| 13 | Other Fixed Assets | 99,21,589 | - | 39,036 | 39,036 | 15,39,706 | 84,20,919 | 62,56,557 | 14,25,084 | 15% | 5,38,418 | 53,69,891 | 30,51,028 | 36,65,032 |
| | **Total** | **1,15,49,34,658** | **3,69,78,508** | **4,53,34,962** | **8,23,13,470** | **55,03,556** | **1,23,17,44,572** | **79,56,86,073** | **50,17,172** | | **6,16,33,473** | **85,23,02,374** | **37,94,42,194** | **35,92,48,582** |
| | Capital Work-in-progress | **54,48,777** | **68,57,504** | **31,87,850** | **1,00,45,354** | **-** | **1,54,94,131** | **-** | **-** | | **-** | **-** | **1,54,94,131** | **54,48,777** |
| | **Grand Total** | **1,16,03,83,435** | **4,38,36,012** | **4,85,22,812** | **9,23,58,824** | **55,03,556** | **1,24,72,38,703** | **79,56,86,073** | **50,17,172** | | **6,16,33,473** | **85,23,02,374** | **39,49,36,323** | **36,46,97,358** |
| | | | | | | | | | | | | | | |
| | **Previous Year** | **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** |

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

*Amount in ₹*

| | | Gross Block | | | | | | Depreciation | | | | | Net Block | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Additions During the Year | | | | | | | | | | | |
| Sr. No. | Particulars | Cost/Valuation as on beginning of the year | On or Before 30th September | After 30th September | Total 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) |
| 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 | 30,38,272 | - | 0% | 1,71,770 | 32,10,042 | 1,35,35,669 | 1,37,07,439 |
| 2 | Building | | | | | | | | | | | | | |
| | a) On Freehold Land | 21,87,89,031 | - | - | - | - | 21,87,89,031 | 13,12,49,191 | - | 10% | 87,53,984 | 14,00,03,175 | 7,87,85,856 | 8,75,39,840 |
| | b) On Leasehold Land | 13,27,01,184 | - | 54,12,50,563 | 54,12,50,563 | - | 67,39,51,747 | 10,94,56,130 | - | 10% | 5,64,49,561 | 16,59,05,691 | 50,80,46,056 | 2,32,45,054 |
| | c) Ownership Flats/Premises | 33,41,269 | - | - | - | - | 33,41,269 | 30,43,338 | - | 10% | 29,793 | 30,73,131 | 2,68,138 | 2,97,931 |
| | d) Superstructures on Land not belonging to the entity | 53,89,260 | - | - | - | - | 53,89,260 | 5,38,926 | - | 10% | 4,85,033 | 10,23,959 | 43,65,301 | 48,50,334 |
| 3 | Plant, Machinery and Equipments | 9,10,19,283 | - | - | - | - | 9,10,19,283 | 8,08,88,489 | - | 15% | 15,19,619 | 8,24,08,108 | 86,11,175 | 1,01,30,794 |
| 4 | Vehicles | 1,00,13,336 | - | - | - | 18,84,619 | 81,28,717 | 92,75,859 | 17,61,079 | 15% | 92,090 | 76,06,870 | 5,21,847 | 7,37,477 |
| 5 | Furniture & Fixtures | 13,92,51,480 | 3,30,129 | 97,74,865 | 1,01,04,994 | 2,21,696 | 14,91,34,778 | 9,76,93,765 | 2,00,569 | 10% | 51,64,158 | 10,26,57,354 | 4,64,77,424 | 4,15,57,715 |
| 6 | Office Equipments | 5,25,22,995 | 60,339 | 33,20,692 | 33,81,031 | 2,40,335 | 5,56,63,691 | 4,58,73,302 | 2,25,490 | 15% | 15,02,382 | 4,71,50,194 | 85,13,497 | 66,49,693 |
| 7 | Air Conditioning Equipments | 5,50,58,421 | - | 36,26,600 | 36,26,600 | 67,700 | 5,86,17,321 | 4,57,50,830 | 60,740 | 15% | 19,39,085 | 4,76,29,175 | 1,09,88,146 | 93,07,591 |
| 8 | Computer Peripherals | 1,09,57,46,059 | 4,90,57,978 | 2,58,61,926 | 7,49,19,904 | 13,658 | 1,17,06,52,305 | 1,08,60,08,938 | 13,640 | 40% | 3,38,62,803 | 1,11,98,58,101 | 5,07,94,204 | 97,37,121 |
| 9 | Electrical Installations | 6,82,87,343 | - | 1,00,03,598 | 1,00,03,598 | - | 7,82,90,941 | 5,22,16,138 | - | 10% | 26,07,480 | 5,48,23,618 | 2,34,67,323 | 1,60,71,205 |
| 10 | Electronic Tools & Lab Equipments | 10,16,70,235 | - | - | - | - | 10,16,70,235 | 9,08,69,562 | - | 15% | 16,20,101 | 9,24,89,663 | 91,80,572 | 1,08,00,673 |
| 11 | Library Books | 3,99,71,365 | 5,000 | 15,222 | 20,222 | - | 3,99,91,587 | 3,99,33,199 | - | 40% | 23,355 | 3,99,56,554 | 35,033 | 38,166 |
| 12 | Copyright Know-how | 4,40,660 | - | - | - | - | 4,40,660 | 4,40,650 | - | 25% | 3 | 4,40,653 | 7 | 10 |
| 13 | Other Fixed Assets | 71,97,523 | 1,350 | 1,49,680 | 1,51,030 | - | 73,48,553 | 64,41,770 | - | 15% | 1,36,019 | 65,77,789 | 7,70,764 | 7,55,753 |
| | **Total** | **2,04,30,50,005** | **4,94,54,796** | **59,40,03,146** | **64,34,57,942** | **24,28,008** | **2,68,40,79,939** | **1,80,27,18,359** | **22,61,518** | | **11,43,57,236** | **1,91,48,14,077** | **76,92,65,862** | **24,03,31,646** |
| | Capital Work-in-progress | 1,65,76,70,462 | - | 3,14,74,000 | 3,14,74,000 | 54,12,50,563 | **1,14,78,93,899** | - | - | | - | - | 1,14,78,93,899 | 1,65,76,70,462 |
| | **Grand Total** | **3,70,07,20,467** | **4,94,54,796** | **62,54,77,146** | **67,49,31,942** | **54,36,78,571** | **3,83,19,73,838** | **1,80,27,18,359** | **22,61,518** | | **11,43,57,236** | **1,91,48,14,077** | **1,91,71,59,761** | **1,89,80,02,108** |
| | **Previous Year** | 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 |

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

*Amount in ₹*

| Sr.No. | Name of the Project | Gross 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 | | | | Net Block | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | On or Before 30th September | After 30th September | Total Additions during 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) |
| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| 1 | Bangalore Centre Project Assets | 36,04,83,078 | 24,10,426 | 1,29,17,445 | 1,53,27,871 | - | 37,58,10,949 | 32,87,91,861 | - | | 1,45,47,959 | 34,33,39,820 | 3,24,71,129 | 3,16,91,217 |
| 2 | Chennai Centre Project Assets | 9,70,49,665 | 12,95,184 | 2,12,169 | 15,07,353 | - | 9,85,57,018 | 8,74,33,944 | - | | 28,20,724 | 9,02,54,668 | 83,02,350 | 96,15,721 |
| 3 | Corporate Project Assets | - | - | - | - | - | - | - | - | | - | - | - | - |
| 4 | Delhi Centre Project Assets | 15,72,623 | - | - | - | - | 15,72,623 | 15,67,699 | - | | 772 | 15,68,471 | 4,152 | 4,924 |
| 5 | Hyderabad Centre Project Assets | 36,03,79,862 | - | 6,79,06,936 | 6,79,06,936 | - | 42,82,86,798 | 28,67,64,369 | - | | 5,28,56,390 | 33,96,20,759 | 8,86,66,039 | 7,36,15,493 |
| 6 | Kolkata Centre Project Assets | 3,50,91,507 | 11,67,027 | 37,05,059 | 48,72,086 | - | 3,99,63,593 | 2,86,35,873 | - | | 40,93,731 | 3,27,29,604 | 72,33,989 | 64,55,634 |
| 7 | Mohali Centre Project Assets | 11,71,27,039 | 40,21,657 | 1,99,57,815 | 2,39,79,472 | - | 14,11,06,511 | 10,08,12,760 | - | | 1,40,20,380 | 11,48,33,140 | 2,62,73,371 | 1,63,14,279 |
| 8 | Mumbai Centre Project Assets | 32,93,39,744 | 10,898 | 3,15,93,408 | 3,16,04,306 | - | 36,09,44,050 | 30,31,00,825 | - | | 1,97,02,256 | 32,28,03,081 | 3,81,40,969 | 2,62,38,919 |
| 9 | Noida Centre Project Assets | 12,28,41,879 | 57,60,422 | 70,16,178 | 1,27,76,600 | - | 13,56,18,479 | 9,57,73,479 | - | | 1,25,44,296 | 10,83,17,775 | 2,73,00,704 | 2,70,68,399 |
| 10 | Patna Centre Project Assets | - | - | - | - | - | - | - | - | | - | - | - | - |
| 11 | Pune Centre Project Assets | 1,65,57,31,252 | 42,76,19,435 | 59,22,13,988 | 1,01,98,33,423 | - | 2,67,55,64,675 | 1,02,66,02,193 | - | | 65,95,11,857 | 1,68,61,14,050 | 98,94,50,625 | 62,91,29,060 |
| 12 | Silchar Centre Project Assets | - | - | - | - | - | - | - | - | | - | - | - | - |
| 13 | Thiruvananthapuram Centre Project Assets | 92,52,81,677 | 30,70,54,018 | 15,98,58,586 | 46,69,12,604 | 4,46,577 | 1,39,17,47,704 | 51,46,74,532 | 1,62,739 | | 21,20,52,684 | 72,65,64,477 | 66,51,83,227 | 41,06,07,145 |
| | **Total** | **4,00,48,98,326** | **74,93,39,067** | **89,53,81,584** | **1,64,47,20,651** | **4,46,577** | **5,64,91,72,400** | **2,77,41,57,535** | **1,62,739** | | **99,21,51,049** | **3,76,61,45,845** | **1,88,30,26,555** | **1,23,07,40,791** |
| | Capital Work-in-progress | - | - | - | - | - | - | - | - | | - | - | - | - |
| | **Grand Total** | **4,00,48,98,326** | **74,93,39,067** | **89,53,81,584** | **1,64,47,20,651** | **4,46,577** | **5,64,91,72,400** | **2,77,41,57,535** | **1,62,739** | | **99,21,51,049** | **3,76,61,45,845** | **1,88,30,26,555** | **1,23,07,40,791** |
| | | | | | | | | | | | | | | |
| | **Previous Year** | **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** |

*Amount in ₹*

| Particulars | 2021-22 | 2020-21 |
|---|---|---|
| **Schedule 8 - Current Assets, Loans and Advances** | | |
| **A. Current Assets** | | |
| 1. Inventories : | | |
| a) Stock in trade | | |
| Finished Goods | 81,26,221 | 58,07,05,260 |
| Work-in-progress | 14,95,56,884 | 72,834 |
| Raw Material | 29,73,995 | 12,45,763 |
| b) Stock of Course Material | 18,59,044 | 16,53,863 |
| 2. Sundry Debtors | | |
| Trade Receivables | 1,51,30,21,637 | 1,46,02,65,657 |
| Less: Provision for Bad and Doubtful Debts | 32,33,70,964 | 29,60,98,157 |
| | 1,18,96,50,673 | 1,16,41,67,500 |
| 3. Cash balances in hand (including cheques/drafts and imprest) | 8,921 | 2,577 |
| 4. Bank Balances | | |
| a) With Scheduled Banks | | |
| On Deposit Accounts (includes margin money) | 12,95,63,97,052 | 13,14,63,26,030 |
| On Savings/Current Account | 5,03,36,62,034 | 2,08,74,75,566 |
| b) Funds/Goods in Transit | 61,79,870 | 17,33,442 |
| 5. Post Office-Savings Accounts | 8,132 | 10,234 |
| **Total (A)** | 19,34,84,22,826 | 16,98,33,93,069 |
| **B. Loans, Advances and Other Assets** | | |
| 1. Loans | | |
| a) Staff | 49,73,243 | 41,75,543 |
| b) Other (Specify) | 9,25,837 | 12,06,997 |
| 2. Advances and other amounts recoverable in cash or in kind or for value to be received | | |
| a) On Capital Account | 50,89,256 | 3,60,13,256 |
| b) Prepayments (Advances to Suppliers) | 31,84,82,731 | 14,71,16,342 |
| c) To Employees | 74,94,088 | 23,30,322 |
| d) To Others | 62,30,41,899 | 18,08,37,631 |
| 3. Income Accrued | | |
| a) On Investments from Earmarked/Endowment Funds | - | - |
| b) On Bank Deposits | 19,90,89,098 | 21,48,86,182 |
| c) Others | | |
| I) Course Fee Receivable | 21,25,513 | 14,93,775 |
| ii) Receivable from Guest House Receipts | - | - |
| iii) Other Grants Receivables | - | 8,05,68,000 |
| 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 | 17,18,60,362 | 20,00,26,911 |
| d) Sales Tax / VAT Refund Due | - | 49,668 |
| e) CGST Receivable | 63,12,248 | 81,27,780 |
| f) SGST Receivable | 62,18,678 | 81,27,780 |
| g) IGST Receivable | 1,17,94,385 | 1,26,03,921 |
| h) UTGST Receivable | - | - |
| i) Reverse Charge GST Receivable | - | 8,710 |
| j) Input Tax Credit GST Receivable | 1,65,61,908 | 1,09,61,817 |
| k) GST Paid on Advance Receipt | 4,38,70,794 | 8,06,11,558 |
| l) Receivable from PF Trust | - | - |
| m) Other Receivables | 96,70,890 | 72,61,798 |
| 5. Prepaid Expenses | | |
| a) Insurance | 16,76,188 | 9,31,037 |
| b) Other Expenses | 4,16,86,446 | 1,51,42,009 |
| 6. Deposits (Assets) | | |
| a) Telephone Deposit | 12,61,715 | 12,47,215 |
| b) Lease Rent Deposit | 4,00,98,792 | 4,00,98,792 |
| c) Other Deposits | 2,62,74,639 | 2,67,12,268 |
| d) Security Deposit | 1,39,96,104 | 1,33,38,042 |
| e) EMD / Tender Deposit | 2,05,08,466 | 2,01,68,615 |
| 7. Differed Expenses | | |
| a) Unutilised Modvat / Cenvat | - | - |
| **Total (B)** | 1,57,36,38,634 | 1,11,46,71,323 |
| **Total (A+B)** | **20,92,20,61,460** | **18,09,80,64,392** |

*Amount in ₹*

| Particulars | 2021-22 | 2020-21 |
|---|---|---|

**Schedule 9 - Income from Sales/Services**

| | | |
|---|---|---|
| **1. Income from Sales** | | |
| a) Sale of Finished Goods | 81,91,76,874 | 56,72,86,539 |
| b) Sale of Raw Material | - | - |
| c) Sale of Scraps | 5,94,545 | 3,94,459 |
| **2. Income from Services** | | |
| a) Software Development Charges | 77,76,27,784 | 63,14,50,769 |
| b) Others (Specify) | - | - |
| AMC Charges Received | 13,07,61,031 | 6,84,26,334 |
| Consultancy Charges / Service Charges | 2,73,50,48,427 | 1,77,09,88,807 |
| TOT Fees Received | 1,89,68,644 | 90,00,000 |
| Royalty Received | 77,95,260 | 9,60,000 |
| Data Charges | 12,11,88,759 | 9,52,50,862 |
| **3. Inter Unit / Inter Branch Sales / (Purchases)** | (77,17,019) | 26,46,810 |
| **Total** | **4,60,34,44,305** | **3,14,64,04,580** |

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

| | | |
|---|---|---|
| 1. Central Government | 2,17,00,00,000 | 1,25,00,00,000 |
| 2. Others (Specify) | | |
| a) C-DAC's own Contribution and Other Adjustments | 7,51,58,855 | 9,97,22,324 |
| 3. Less : Amount utilised for Capital Expenditure in the current year transferred to Capital Reserve | 10,25,90,624 | 1,52,70,186 |
| **Total** | **2,14,25,68,231** | **1,33,44,52,138** |

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

| | | |
|---|---|---|
| 1. Entrance Fees | - | - |
| 2. Course Fees | 88,21,10,287 | 18,67,80,191 |
| 3. Corporate Training Fees | 54,28,579 | 31,36,016 |
| 4. Annual Fees/Subscriptions | 27,31,581 | 96,19,020 |
| 5. Authorization Fees | 7,79,700 | - |
| 6. Others (Specify) | - | - |
| a) Virtual Centre Processing Fees | - | - |
| b) Admission Cancellation Fees | 27,85,575 | 6,96,865 |
| c) Examination Fees | 3,62,28,381 | 33,36,506 |
| d) Late Fee | 8,906 | 1,958 |
| e) Registration Fees / Project Fee | 1,68,610 | 4,31,995 |
| f) Students Hostel Fees | (2,71,451) | 8,33,839 |
| **TOTAL** | **92,99,70,168** | **20,48,36,390** |

**Schedule 12 - Interest Received**

| | | |
|---|---|---|
| **1. On Term Deposits** | | |
| a) With Scheduled Banks | 25,74,31,447 | 26,48,81,112 |
| **2. On Savings Accounts** | | |
| a) With Scheduled Banks | 2,38,41,893 | 2,48,62,340 |
| **3. On Loans** | | |
| a) Employees/Staff | 1,61,864 | 2,04,662 |
| **Total** | **28,14,35,204** | **28,99,48,114** |

**Schedule 13 - Other Income**

| | | |
|---|---|---|
| 1. Profit on Sale/Disposal of Assets | | |
| a) Owned Assets | 2,93,957 | 1,57,279 |
| b) Assets acquired out of grants, or received free of cost | 1,17,290 | (90,669) |
| 2. Exports Incentives Realized | - | - |
| 3. Fees for Miscellaneous Services | 8,83,127 | 14,77,298 |
| 4. Miscellaneous Income | 1,21,72,730 | 1,38,28,043 |
| **Total** | **1,34,67,104** | **1,53,71,951** |

*Amount in ₹*

| Particulars | 2021-22 | 2020-21 |
|---|---|---|

**Schedule 14 - Increase/(Decrease) In Stock of Finished Goods & Work-In-Progress**

| | | |
|---|---|---|
| a) Closing Stock | | |
| Finished Goods | 81,26,221 | 58,07,05,260 |
| Work-in-progress | 14,95,56,884 | 72,834 |
| Raw Material | 29,73,995 | 5,58,802 |
| Loose Tools | - | - |
| Course Material Stock | 18,59,044 | 16,53,863 |
| b) Less : Opening Stock | | |
| Finished Goods | 58,07,05,260 | 70,18,72,582 |
| Work-in-progress | 72,834 | 1,05,008 |
| Raw Material | 5,58,802 | 6,43,901 |
| Loose Tools | - | - |
| Course Material Stock | 16,53,863 | 15,19,242 |
| **Total (a-b)** | **(42,04,74,615)** | **(12,11,49,974)** |

**Schedule 15 - Establishment Expenses**

| | | |
|---|---|---|
| **a) Salaries & Wages** | 2,46,97,39,937 | 2,17,93,74,443 |
| **b) Allowances & Bonus** | | |
| Awards & Prizes | 1,10,400 | 2,69,452 |
| Bonus | (2,15,879) | 48,962 |
| Canteen Facility | 2,03,43,063 | 1,88,62,013 |
| Hire Charges - Contractual Services | 18,30,18,278 | 11,93,41,845 |
| Lease Rent for Employees Quarters | - | - |
| Leave Travel Concession | 59,79,470 | 3,14,18,591 |
| Medical Reimbursement | 11,28,18,250 | 9,12,06,919 |
| Members Medical & Accident Insurance Expenses | 9,52,168 | 5,76,953 |
| Misc. Allowances and Other Reimbursements | 2,38,23,622 | 2,42,71,650 |
| Staff Recruitment Expenses | 30,56,766 | 31,02,959 |
| Staff Training Expenses | 16,27,889 | 12,97,739 |
| Transfer & Relocation Expenses | 4,22,047 | 8,05,074 |
| **c) Contribution to Provident Fund** | 21,11,95,851 | 17,98,78,276 |
| **d) Staff Welfare Expenses** | 67,35,321 | 45,48,197 |
| **e) Expenses on Employees Retirement and Terminal Benefits** | - | - |
| Gratuity | 21,85,60,404 | 10,88,71,193 |
| Leave Encashment | 22,02,54,822 | 6,76,14,563 |
| Leave Salary & Pension Contribution | 10,08,42,748 | 58,34,366 |
| **f) Others** | - | 2,46,467 |
| **Total** | **3,57,92,65,157** | **2,83,75,69,662** |

**Schedule 16 - Other Administrative Expenses**

| | | |
|---|---|---|
| **a) Purchases** | 61,62,43,186 | 39,77,76,833 |
| **b) Direct Expenses** | | |
| Consumables | 3,69,33,893 | 1,59,54,657 |
| Design and Development Charges | 5,740 | - |
| Excise/Custom Duty/Service Tax Paid | 16,49,464 | 12,68,506 |
| Freight and Handling Expenses | 11,42,111 | 37,593 |
| Labour Charges | 2,950 | 5,65,335 |
| Liquidated Damages | (12,71,200) | 28,80,400 |
| Material Insurance Expenses | - | - |
| Other Packing Charges | 56,368 | 32,370 |
| Royalty and Support Fees | - | 8,32,023 |
| Software Development Consultancy Charges | 97,16,530 | 1,98,71,746 |
| Technical Service Charges | 60,64,51,283 | 44,24,02,482 |
| Warehouse Charges | - | - |
| **c) Expenses on Courses** | | |
| Advertisement Expenses | 1,37,11,850 | 70,73,102 |
| ATC's Share in Fees | 33,21,66,674 | 4,71,27,456 |
| Awards & Prizes | 17,250 | - |
| Campus Interview Expenses | 2,33,500 | 6,38,713 |
| Course Material Production Expenses | 23,54,463 | 32,71,908 |
| Data Entry & Scanning Expenses | - | - |
| Examination Expenses | 47,19,780 | 7,12,563 |
| Faculty Members Expenses | 3,12,46,011 | 1,68,19,104 |
| Other Course Related Expenses | 60,88,133 | 1,41,68,047 |
| Printing of Forms & Prospectus | 66,540 | 1,481 |
| Students Hostel Expenses | 4,100 | 81,631 |

*Amount in ₹*

| Particulars | 2021-22 | 2020-21 |
|---|---|---|
| **d) Administrative Expenses** | | |
| Administrative Charges on Provident Fund | 81,15,289 | 70,61,248 |
| Asset Hire Charges | 68,91,178 | 7,63,107 |
| Auditors Remuneration | 12,95,158 | 15,79,615 |
| Bank Charges and Commission | 22,45,080 | 12,33,321 |
| C-DAC's Contribution to Funded Projects | 13,24,77,724 | 2,34,59,064 |
| Cultural Program Expenses | 13,66,682 | 6,08,124 |
| Development Contracts and Spon. Project Expenses | - | 66,22,856 |
| Electricity, Power and Water Charges | 5,95,91,060 | 6,34,01,965 |
| Entertainment/Hospitality Expenses | 20,14,415 | 13,83,409 |
| Foreign Exchange Fluctuation | (60,471) | 1,81,556 |
| Gifts and Presentation | 4,95,484 | 32,951 |
| Insurance | 16,90,734 | 22,85,850 |
| Interest Paid | 5,28,469 | 4,06,655 |
| Irrecoverable Balances Written-off/(Written-back) | 18,07,348 | 32,56,242 |
| Legal & Professional Charges | 2,78,15,287 | 1,68,89,443 |
| Miscellaneous Expenses | 19,07,871 | 24,72,490 |
| Office Expenses | 79,41,197 | 80,30,658 |
| Postage, Telephone & Communication Charges | 1,97,06,431 | 1,86,97,538 |
| Printing and Stationery | 43,85,240 | 34,04,282 |
| Provision for Bad and Doubtful Debts/Advances | 3,83,63,847 | 2,86,72,384 |
| Rent, Rates and Taxes | 5,14,32,665 | 3,92,97,252 |
| CGST Paid | - | 10,242 |
| SGST Paid | - | 10,242 |
| IGST Paid | - | - |
| UTGST Paid | - | - |
| Reverse Charge GST Paid | - | - |
| Service Hire Charges | 11,35,86,749 | 9,05,84,451 |
| Subscription of Periodicals & Newspapers | 19,80,204 | 18,51,455 |
| Tender Expenses | 20,098 | 40,540 |
| Training Expenses | 1,86,928 | 20,81,069 |
| Transit Quarter & Guest House Expenses | 26,87,864 | 8,94,001 |
| Transportation Charges | 96,056 | 45,710 |
| Vehicles Hire, Running and Maintenance | 77,38,678 | 59,36,339 |
| **e) Repairs and Maintenance** | | |
| Air Conditioning Equipments | 18,89,858 | 51,31,005 |
| Building | 87,26,635 | 92,02,128 |
| Computers | 64,13,344 | 81,49,046 |
| Electrical Fittings | 1,83,83,085 | 1,43,07,374 |
| Furniture and Fixtures | 18,72,679 | 10,81,476 |
| Garden Maintenance | 13,51,850 | 9,13,913 |
| Lab Equipments | 1,43,703 | 1,46,888 |
| Office Equipments | 33,63,739 | 9,80,156 |
| Other Assets | 41,24,769 | 38,06,012 |
| **f) Travelling and Conveyance Expenses** | | |
| Inland Travel Expenses | | |
| Director | 6,06,322 | 6,40,677 |
| Members | 6,57,54,952 | 3,20,08,428 |
| Others | 21,56,539 | 6,78,280 |
| Foreign Travel Expenses | | |
| Director | - | - |
| Members | - | - |
| Others | 8,719 | - |
| Conveyance Expenses | 10,926 | 12,55,280 |
| **g) Selling Distribution and Business Promotion Expenses** | | |
| Advertisement Expenses | 19,76,819 | 15,42,119 |
| Expenses on Exhibition, Seminars/Workshops | 45,21,416 | 5,22,720 |
| Distribution Expenses | - | - |
| Product Literature & Brochures Expenses | - | - |
| Other Sales Promotion Expenses | 13,28,769 | 7,91,026 |
| **h) Corporate Office Expenses** | - | - |
| **i) Other Expenses** | - | - |
| **Total Other Administrative Expenses** | **2,28,04,80,015** | **1,38,38,66,537** |

# 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** | **Sunil Misar** | **Magesh Ethirajan** |
|---|---|---|
| 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 : 22151410ATZRGU6970**

**Date : 22nd September, 2022**
**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 ₹1,074.70 Lakhs (Previous year ₹16,320.54 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 ₹1,442.65 Lakhs (Previous year ₹1,757.89 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 ₹1,10,586.75 Lakhs (Previous year ₹94,305.61 Lakhs) and ₹1,099.61 Lakhs (Previous year ₹1,290.82Lakhs) grants receivable on account of expenditure incurred in anticipation of release of grants on projects.

## 4. Contingent Liabilities

4.1. Against Bank Guarantees: ₹1,115.83 Lakhs. (Previous year ₹1,461.58 Lakhs)
4.2. Against Letter of Credit is Nil (Previous year is Nil)
4.3. Against Liquidated Damages is Nil (Previous year is Nil)
4.4. Against Sales Tax: ₹6.84 Lakhs (Previous year ₹18.06 Lakhs)
4.5. Against Service Tax: ₹11,474.72 Lakhs (Previous year ₹60.02Lakhs)
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. GST is under reconciliation for the FY2021-22.

## 5. Statutory Liabilities

The entire income of C-DAC is exempt u/s 10(21) being a scientific research association notified under section 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 | 225.01 | 177.78 | 402.79 |
| Previous Year | 712.29 | 324.57 | 1,036.86 |

6.2 **Expenditure in foreign currency for Travel:** Nil. (Previous Year is Nil)
6.3 **Other Expenditure in foreign currency**: ₹4,081.69 Lakhs (Previous Year ₹19.22 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 | 0.00 |
| Euro | 0.00 | 0.00 |
| Total Value in ₹ (In Lakhs) | 0.00 | 0.00 |

**7. Remuneration to Statutory Auditors ( Including Branch Auditors)**

**(₹ in Lakhs)**

| Particulars | Current Year | Previous Year |
|---|---|---|
| Audit Fees ( Exclusive of GST ) | 3.26 | 2.98 |

**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 ₹3,746.69 Lakhs (Previous year ₹3,303.23 Lakhs) a provision of ₹3,233.70 Lakhs (Previous year ₹2,960.98 Lakhs) has been made up to 31st March, 2022. Provision for ₹512.99 Lakhs (Previous year ₹342.25 Lakhs) has not been made {Noida ₹512.99 Lakhs (Previous year ₹314.44 Lakhs) and Mohali ₹0.00 Lakhs (Previous year ₹27.81 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 | 218.82 | 4.74 | 1.17 | 3.67 | 71.94 | 300.34 |
| Chennai | 51.66 | 12.87 | 2.90 | 0.00 | 0.00 | 67.43 |
| Delhi | 114.11 | 0.77 | 126.91 | 0.00 | 136.48 | 378.27 |
| Hyderabad | 195.52 | 2.23 | 60.28 | 1.54 | 3.14 | 262.71 |
| Kolkata | 10.91 | 0.00 | 1.33 | 0.04 | 11.78 | 24.06 |
| Mohali | 259.44 | 42.09 | 28.81 | 45.76 | 134.67 | 510.77 |
| Mumbai | 2189.14 | 17.07 | 95.23 | 37.17 | 655.92 | 2994.53 |
| Noida | 2157.60 | 614.54 | 421.27 | 455.25 | 1294.50 | 4943.16 |
| Patna | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pune | 1730.63 | 0.00 | 81.45 | 103.55 | 1218.00 | 3133.63 |
| Silchar | 103.84 | 188.08 | 20.53 | 0.00 | 25.09 | 337.54 |
| Thiruvananth--apuram | 1715.55 | 80.67 | 177.91 | 8.50 | 195.17 | 2177.80 |
| **Total** | **8747.22** | **963.06** | **1017.79** | **655.48** | **3746.69** | **15130.24** |
| **Previous Year** | **7747.60** | **1179.71** | **1285.59** | **1086.52** | **3303.23** | **14602.65** |

**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**

Reconciliation of physical verification & related reports for FY 2021-22 is in progress and the same will be completed in FY 2022-23.

**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 ₹213.82 Lakhs (Previous year ₹205.30 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 ₹0.12 Lakhs as advances paid to Director General (Previous Year ₹0.00 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.

19.2. **Mumbai Centre**

19.2.1. The matter of dispute in Rent along with Interest payable for the period April-1995 to October-2013 to M/s. Air India Limited has settled by C-DAC through the Administrative Mechanism for Resolution of Central Public Sector Enterprises Dispute (AMRCD). CDAC has paid the total outstanding amounting to ₹1,698/- Lakhs to M/s. Air India Ltd and the same has been shown under "Prior Period Expenses" in current financial year.

19.2.2. As per the actuarial valuation, total outstanding liability in respect of Pension Fund is ₹4,485/- Lakhs, against which ₹3,982/- Lakhs has been provided in the books of accounts (Fund Value ₹750/- Lakhs plus cumulative provision ₹3,232/- Lakhs) as on 31st March 2022. Provision for ₹503/- 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 (Excluding GST) for a period of 3 years w.e.f. March-2019. The Centre has raised 2nd Invoice for an amount of ₹1,650 Lakhs (15% of project cost) on "SRS & Design document for Phase 1 Modules" and we have received the money on 3/6/2022. We have accounted ₹1,650 Lakhs as Business Income for FY 2021-22. The total Invoices raised on ECGC Ltd. for the above project is ₹3,300 Lakhs..

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 31/03/2022 have been billed by the centre. The amount equivalent to ₹1,462.42 Lakhs is available with the Centre as on 31/03/2022 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 ₹159.80 Lakhs. 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 31/03/2022. The unutilized amount of ₹328.64 Lakhs from the first installment received is shown as "Advance Received from Party".

19.3. **Noida Centre**

19.3.1. In one of the funded project, namely NAVIC GPS project, an advance of ₹500/- 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 ₹13.07 Lakhs for non-consideration input credit against this, an amount of ₹3.26 Lakhs 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 2022.

19.4.4. No provision is made for the Advances to employees against various claims amounting to ₹29.41 Lakhs (Previous year ₹11.54 Lakhs), which will be booked in the FY 2022-23. As most of the claims will directly be debited to the Projects / Grants.

## 19.5. Thiruvananthapuram Centre

19.5.1. 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.

19.5.2. 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.

19.5.3. 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 31-03-2022, an amount of ₹170/- Lakhs has been adjusted and the balance amount of ₹332/- Lakhs will be adjusted against the rent receivable from KSUM in subsequent years.

**20. Inter unit /Inter Branch Sales( Purchases)**

Inter unit/ Inter branch Sales and Purchases is showing an amount of ₹77.17 Lakhs. It includes an amount of ₹105.48 Lakhs pertaining to Chennai Centre Sales which is accounted under Prior Period Income and an amount of ₹(28.31) Lakhs pertaining to Mohali Centre Purchases which is accounted under respective Sponsored Project Expenses.

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

**22.** Centre wise Financial Performance is attached as Schedule 18-A and Centre wise details of Assets and Liabilities, Income & Expenditure is attached as Schedule 18-B.

**23.** 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.

**24.** Figures in the Financial Statements are rounded off to nearest Indian Rupees.

| **Indira Pasupathy** | **Sunil Misar** | **Magesh Ethirajan** |
|---|---|---|
| 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 : 22151410ATZRGU6970**

**Date : 22nd September, 2022**
**Place : Pune**

**Schedule 18-A:**

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

## FINANCIAL PERFORMANCE OF C-DAC FOR THE FINANCIAL YEAR 2021-22

*Amount in Lakhs*

| S.No | Particulars | Total | Bangalore | Chennai | Corporate | Delhi | Hyderabad | Kolkata | Mohali | Mumbai | Noida | Patna | Pune | Silchar | TVM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | **OPENING BALANCE** | | | | | | | | | | | | | | |
| (i) | **Grant -in- Aid: Core Grant Projects** | **(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 | 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) | 0.00 | (471.26) |
| (ii) | **Grant for 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 | 33568.51 | 0.00 | 6091.31 |
| | 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 | 0.00 | 169.96 |
| B | **RECEIPTS & INCOME** | | | | | | | | | | | | | | |
| (i) | **Grant -in- Aid** | **21700.00** | | | | | | | | | | | | | |
| | GIA General | 21700.00 | 2494.45 | 784.32 | 880.00 | 406.22 | 524.45 | 725.92 | 1192.75 | 2828.40 | 1727.47 | 0.00 | 6706.15 | 78.77 | 3351.10 |
| | 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 | 0.00 |
| (ii) | **Grant for Sponsored Projects** | **71544.32** | | | | | | | | | | | | | |
| | MeitY | 21568.14 | 4305.31 | 153.43 | 0.00 | 170.93 | 234.22 | 964.69 | 2130.28 | 1220.04 | 1404.24 | 0.00 | 1361.82 | 0.00 | 9623.18 |
| | Other Agencies | 49976.18 | 87.56 | 0.00 | 0.00 | 425.29 | 530.49 | 151.77 | 6657.99 | 0.00 | 126.53 | 0.00 | 41763.21 | 0.00 | 233.34 |
| (iii) | **Revenue Earnings** | **55334.13** | | | | | | | | | | | | | |
| | Training | 16349.76 | 709.30 | 147.95 | 0.00 | 98.79 | 373.12 | 88.41 | 471.70 | 573.62 | 1122.27 | 17.37 | 12491.30 | 14.10 | 241.83 |
| | Commercial | 38984.37 | 624.07 | 1141.46 | 0.00 | 170.80 | 676.69 | 1531.63 | 3665.11 | 4700.78 | 5925.51 | 53.32 | 6985.13 | 516.13 | 12993.74 |
| (iv) | | | | | | | | | | | | | | | |
| | **Interest, Other Income & C-DAC Contribution** | **1377.33** | | | | | | | | | | | | | |
| | GIA General | 752.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.76 | 0.00 | 750.09 | 0.00 | 0.00 | 0.00 |
| | Core Grant Projects | 624.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 485.92 | 0.00 | 138.56 |
| | | **5060.20** | | | | | | | | | | | | | |
| | MeitY Spon Projects | 1940.94 | 20.83 | 0.00 | 0.00 | 0.65 | 100.97 | (2.79) | 48.10 | 25.56 | 271.54 | 0.00 | 1046.92 | 0.00 | 429.16 |
| | Spon. By Other Agencies | 3119.26 | 4.76 | 0.00 | 0.00 | 0.06 | 36.02 | 0.06 | 116.56 | 9.42 | 6.36 | 0.00 | 2906.57 | 0.00 | 39.45 |
| | | **(1098.01)** | | | | | | | | | | | | | |
| | Training | 1016.04 | 53.13 | 6.79 | 48.56 | 0.75 | 76.02 | 0.71 | 215.54 | 5.27 | 380.83 | 0.00 | 183.99 | 0.00 | 44.45 |
| | Commercial | (2114.05) | 83.00 | 105.48 | 84.43 | 76.49 | 219.62 | 59.72 | 28.80 | 86.70 | 399.53 | 11.54 | 418.10 | 5.46 | (3692.92) |
| | **TOTAL (A+B)** | **245857.13** | **9578.09** | **2339.73** | **1012.99** | **2526.87** | **6929.20** | **4250.03** | **15215.51** | **10099.20** | **21448.59** | **1553.68** | **141096.88** | **614.46** | **29191.90** |
| C | **REVENUE Expenditure** | | | | | | | | | | | | | | |
| (i) | **Expenditure from Grant-In-Aid** | **21459.10** | | | | | | | | | | | | | |
| | GIA General | **21459.10** | | | | | | | | | | | | | |
| | Establishment Expenses | 17727.61 | 2191.45 | 709.32 | 730.00 | 296.22 | 464.45 | 655.92 | 1032.74 | 988.40 | 1527.47 | 227.62 | 5884.15 | 73.77 | 2946.10 |
| | Other Administrative Expenses | 3731.49 | 230.00 | 75.00 | 134.62 | 30.00 | 60.00 | 70.00 | 86.24 | 1804.35 | 160.08 | 66.20 | 705.00 | 5.00 | 305.00 |
| | 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 | 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 | 0.00 |
| (ii) | **Expenditure on Sponsored Projects** | **36748.21** | | | | | | | | | | | | | |
| | MeitY Total Expenses | **22356.69** | | | | | | | | | | | | | |
| | Establishment Expenses | 11230.40 | 554.14 | 103.37 | 0.00 | 142.35 | 874.08 | 424.41 | 231.52 | 443.07 | 2279.20 | 0.00 | 3622.35 | 0.00 | 2555.91 |
| | Other Administrative Expenses | 11126.29 | 4111.33 | 33.76 | 0.00 | 87.99 | 288.29 | 909.00 | 95.97 | 287.90 | 3475.86 | 0.00 | 1228.95 | 0.00 | 607.24 |
| | Other Agencies Total Expenses | **14391.52** | | | | | | | | | | | | | |
| | Establishment Expenses | 2263.72 | 11.71 | 0.00 | 0.00 | 324.39 | 393.81 | 96.03 | 643.63 | 0.00 | 137.63 | 39.10 | 511.03 | 0.00 | 106.39 |
| | Other Administrative Expenses | 12127.80 | 206.41 | 0.00 | 0.00 | 692.73 | 162.44 | 65.13 | 449.75 | 0.00 | 73.51 | 0.00 | 10289.36 | 0.00 | 188.47 |
| (iii) | **Other Revenue Expenditure** | **39484.48** | | | | | | | | | | | | | |
| | Training Total Expenses | **12695.73** | | | | | | | | | | | | | |
| | Establishment Expenses | 4130.49 | 286.27 | 20.77 | 0.00 | 13.30 | 89.03 | 24.63 | 283.65 | 348.03 | 631.87 | 2.45 | 2089.63 | 3.56 | 337.30 |
| | Other Administrative Expenses | 8565.24 | 23.74 | 23.64 | 0.00 | 10.70 | 48.17 | 9.11 | 284.09 | 22.53 | 31.24 | 4.30 | 8059.69 | 2.89 | 45.14 |
| | Commercial Total Expenses | **26788.75** | | | | | | | | | | | | | |
| | Establishment Expenses | 13934.54 | 0.10 | 619.68 | 37.31 | 168.24 | 207.23 | 945.06 | 541.87 | 2606.13 | 3719.17 | 8.29 | 2487.58 | 187.58 | 2406.30 |
| | Other Administrative Expenses | 12854.21 | 77.54 | 369.53 | 0.00 | 80.05 | 46.01 | 409.36 | 1782.62 | 1883.87 | 340.14 | 9.20 | 2374.81 | 102.97 | 5378.11 |
| | **TOTAL C** | **97691.79** | **7692.69** | **1955.07** | **901.93** | **1845.97** | **2633.51** | **3608.65** | **5432.08** | **8384.28** | **12376.17** | **357.16** | **37252.55** | **375.77** | **14875.96** |

**Schedule 18-A:**
*(Attached to and forming an integral part of Balance Sheet)*

**FINANCIAL PERFORMANCE OF C-DAC FOR THE FINANCIAL YEAR 2021-22**

*Amount in Lakhs*

| S.No | Particulars | Total | Bangalore | Chennai | Corporate | Delhi | Hyderabad | Kolkata | Mohali | Mumbai | Noida | Patna | Pune | Silchar | TVM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | **CAPITAL Expenditure** | | | | | | | | | | | | | | |
| (i) | **Expenditure from GIA for Core R&D** | **1335.14** | | | | | | | | | | | | | |
| | GIA General | 1025.90 | 73.00 | 0.00 | 15.38 | 80.00 | 0.00 | 0.00 | 73.76 | 38.41 | 39.92 | 488.43 | 117.00 | 0.00 | 100.00 |
| | Core Grant Projects | 309.24 | 0.00 | 0.00 | 0.00 | 309.24 | 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.** | **16447.21** | | | | | | | | | | | | | |
| | MeitY | 14524.09 | 146.25 | 15.07 | 0.00 | 0.00 | 333.85 | 46.29 | 69.23 | 316.04 | 126.00 | 0.00 | 8810.05 | 0.00 | 4661.30 |
| | Other Agencies | 1923.12 | 7.03 | 0.00 | 0.00 | 0.00 | 345.22 | 2.43 | 170.56 | 0.00 | 1.76 | 0.00 | 1388.29 | 0.00 | 7.83 |
| (iii) | **Expenditure from Own Funds** | **923.56** | | | | | | | | | | | | | |
| | Training | 151.84 | 3.43 | 0.00 | 0.00 | 0.00 | 11.66 | 0.00 | 2.28 | 0.53 | 3.05 | 0.00 | 119.18 | 0.00 | 11.71 |
| | Commercial | 771.72 | 0.00 | 0.53 | 0.00 | 9.66 | 0.00 | 11.34 | 0.53 | 69.50 | 354.06 | 0.00 | 56.30 | 8.72 | 261.08 |
| | **TOTAL D** | **18705.91** | **229.71** | **15.60** | **15.38** | **398.90** | **690.73** | **60.06** | **316.36** | **424.48** | **524.79** | **488.43** | **10490.82** | **8.72** | **5041.92** |
| 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 | 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 | 0.00 |
| (ii) | **From Sponsored Projects** | **6936.74** | | | | | | | | | | | | | |
| | MeitY | 4706.05 | 124.53 | 17.98 | 0.00 | 58.69 | 291.64 | 27.30 | 980.78 | 831.93 | 159.57 | 0.00 | 2113.66 | 0.00 | 99.97 |
| | Other Agencies | 2230.69 | 3.12 | 0.00 | 0.00 | 0.39 | 63.50 | 1.36 | 39.54 | 0.00 | 0.00 | 0.00 | 2118.95 | 0.00 | 3.83 |
| | **TOTAL (E)** | **6936.74** | **127.65** | **17.98** | **0.00** | **59.08** | **355.14** | **28.66** | **1020.32** | **831.93** | **159.57** | **0.00** | **4232.61** | **0.00** | **103.80** |
| | | | | | | | | | | | | | | | |
| F | **TOTAL Expenditure (C+D+E)** | **123334.44** | **8050.05** | **1988.65** | **917.31** | **2303.95** | **3679.38** | **3697.37** | **6768.76** | **9640.69** | **13060.53** | **845.59** | **51975.98** | **384.49** | **20021.68** |
| G | **Unspent Balance / Surplus / Deficit (A+B-F)** | | | | | | | | | | | | | | |
| (i) | **Grant -in- Aid** | **(792.54)** | | | | | | | | | | | | | |
| | GIA General | 650.11 | 0.00 | 0.00 | (0.00) | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | (0.00) | 650.10 | 0.00 | 0.00 | 0.00 |
| | Core Grant Projects | (1442.65) | 0.00 | 0.00 | 0.00 | (1109.95) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | (332.70) |
| (ii) | **Sponsored Projects** | **109487.15** | | | | | | | | | | | | | |
| | MeitY | 36528.63 | 303.67 | (16.45) | 0.00 | 30.40 | 1650.68 | 12.91 | 799.16 | 22.72 | 5304.08 | 0.00 | 20202.24 | 0.00 | 8219.23 |
| | Other Agencies | 72958.52 | 145.95 | 0.00 | 0.00 | 1237.59 | 655.79 | 258.78 | 6161.46 | 0.01 | 335.36 | 0.00 | 64027.33 | 0.00 | 136.23 |
| (iii) | **Other** | **14751.66** | | | | | | | | | | | | | |
| | Training | 4670.09 | 452.42 | 110.33 | 48.56 | 75.54 | 311.94 | 55.38 | 119.50 | 208.33 | 839.99 | 10.62 | 2525.97 | 7.65 | (96.16) |
| | Commercial | 10081.57 | 629.43 | 257.73 | 47.12 | (1.00) | 643.07 | 236.93 | 1369.42 | 297.48 | 2265.73 | 47.37 | 2540.84 | 231.04 | 1516.41 |

**Schedule 18-B:**

## CENTRE WISE BALANCE SHEET AS AT 31st March 2022

*(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 | Silchar | TVM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CORPUS/CAPITAL FUND AND LIABILITIES** | | | | | | | | | | | | | | |
| Corpus/Capital Fund | 58,587.97 | 3,058.74 | 304.81 | 2,697.53 | 2,042.49 | 4,401.49 | 1,406.31 | 5,953.50 | (1,064.10) | 20,297.22 | 70.21 | 16,648.93 | 534.11 | 2,236.73 |
| Reserves and Surplus | 38,001.86 | 505.20 | 113.23 | 21.74 | 3,154.50 | 1,739.31 | 265.96 | 374.44 | 457.37 | 597.19 | 386.64 | 18,599.15 | 9.92 | 11,777.22 |
| Earmarked and Endowment Funds | 1,08,764.26 | 451.66 | (15.57) | - | 158.65 | 2,306.48 | 271.71 | 6,960.63 | 24.11 | 5,639.44 | 650.11 | 84,294.28 | - | 8,022.75 |
| Secured / Unsecured Loan from Bank | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Current Liabilities and Provisions | 45,822.80 | 977.59 | 138.32 | 148.79 | 623.09 | 771.39 | 409.91 | 932.82 | 5,720.40 | 3,769.31 | 22.47 | 12,755.54 | 294.30 | 19,258.86 |
| Branch & Divisions | 0.01 | 346.36 | 158.13 | (450.76) | 16.91 | 10,805.68 | 508.81 | (790.71) | (40.51) | 238.61 | (26.52) | (11,215.15) | (467.86) | 917.02 |
| **Total** | **2,51,176.89** | **5,339.55** | **698.91** | **2,417.30** | **5,995.63** | **20,024.36** | **2,862.71** | **13,430.68** | **5,097.27** | **30,541.77** | **1,102.91** | **1,21,082.75** | **370.47** | **42,212.58** |
| **ASSETS** | | | | | | | | | | | | | | |
| **Fixed Assets** | | | | | | | | | | | | | | |
| Acquired out of Own Funds | 3,949.36 | 469.09 | 7.73 | - | 275.46 | 60.73 | 82.01 | 97.43 | 110.88 | 1,169.15 | - | 1,324.51 | 9.88 | 342.47 |
| Acquired out of Grant in Aid | 19,171.60 | 180.49 | 30.21 | 21.74 | 3,154.46 | 852.65 | 193.62 | 111.70 | 75.96 | 324.18 | 386.64 | 8,704.64 | 9.92 | 5,125.39 |
| Acquired out of Project Grants | 18,830.27 | 324.71 | 83.02 | - | 0.04 | 886.66 | 72.34 | 262.73 | 381.41 | 273.01 | - | 9,894.51 | - | 6,651.83 |
| Investments-from Earmarked/Endowment Funds | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Investments-Others | 5.05 | - | - | - | - | - | - | - | - | 5.05 | - | - | - | - |
| Current Assets, Loans, Advances etc. | 2,09,220.61 | 4,365.26 | 577.95 | 2,395.57 | 2,565.67 | 18,224.32 | 2,514.73 | 12,958.81 | 4,529.01 | 28,770.38 | 716.27 | 1,01,159.08 | 350.67 | 30,092.88 |
| Miscellaneous Expenditure | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Total** | **2,51,176.89** | **5,339.55** | **698.91** | **2,417.30** | **5,995.63** | **20,024.36** | **2,862.71** | **13,430.68** | **5,097.27** | **30,541.77** | **1,102.91** | **1,21,082.75** | **370.47** | **42,212.58** |

## CENTRE WISE INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st March 2022

*Amount in Lakhs*

| Particulars | Total | Bangalore | Chennai | Corporate | Delhi | Hyderabad | Kolkata | Mohali | Mumbai | Noida | Patna | Pune | Silchar | TVM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **INCOME** | | | | | | | | | | | | | | |
| Income from Sales/Services | 46,034.44 | 626.54 | 1,141.46 | - | 172.16 | 676.69 | 1,531.63 | 3,998.06 | 4,700.78 | 6,293.13 | 53.32 | 13,309.50 | 516.13 | 13,015.03 |
| Grants/Subsdies | 21,425.68 | 2,421.45 | 784.32 | 864.62 | 326.22 | 524.45 | 725.92 | 1,118.99 | 2,791.58 | 1,687.55 | 261.57 | 6,589.15 | 78.77 | 3,251.10 |
| Fees/Subscription | 9,299.70 | 706.82 | 147.95 | - | 97.42 | 373.12 | 88.42 | 138.75 | 573.62 | 754.65 | 17.37 | 6,166.93 | 14.10 | 220.55 |
| Interest Earned | 2,814.35 | 90.68 | 6.68 | 111.03 | 75.46 | 280.47 | 55.03 | 201.45 | 48.08 | 768.65 | 11.54 | 563.89 | 0.03 | 601.37 |
| Other Income | 134.67 | 1.50 | 0.10 | 21.96 | 1.79 | 3.72 | 5.41 | 8.95 | 40.82 | 8.38 | 0.09 | 1.72 | 5.43 | 34.80 |
| Prior Period Income | 158.99 | - | 105.48 | - | - | 11.45 | - | 33.95 | 4.25 | 3.33 | - | (0.84) | - | 1.37 |
| Goods and Work-in-progress | (4,204.75) | 43.95 | - | - | - | - | - | - | - | - | - | 37.32 | - | (4,286.01) |
| **Total** | **75,663.08** | **3,890.94** | **2,186.00** | **997.61** | **673.05** | **1,869.89** | **2,406.40** | **5,500.14** | **8,159.13** | **9,515.69** | **343.90** | **26,667.66** | **614.47** | **12,838.20** |
| **EXPENDITURE** | | | | | | | | | | | | | | |
| Establishment Expenses | 35,792.65 | 2,477.83 | 1,349.77 | 767.31 | 477.76 | 760.71 | 1,625.61 | 1,858.26 | 3,942.55 | 5,878.51 | 238.36 | 10,461.36 | 264.92 | 5,689.70 |
| Other Administrative Expenses | 22,804.80 | 306.55 | 465.26 | 134.41 | 106.27 | 141.03 | 464.92 | 2,133.87 | 1,946.79 | 314.46 | 79.69 | 11,029.12 | 106.68 | 5,575.75 |
| Prior Period Expenses | 1,729.80 | - | 1.53 | 0.21 | 1.30 | 2.32 | 3.03 | 0.21 | 1,709.64 | (8.47) | - | (4.74) | - | 24.77 |
| Depreciation (corresponding to Schedule 5) | 616.33 | 24.73 | 1.39 | - | 13.18 | 10.82 | 20.52 | 18.87 | 54.32 | 225.47 | - | 115.13 | 4.18 | 127.72 |
| **Total** | 60,943.58 | 2,809.10 | 1,817.94 | 901.93 | 598.51 | 914.88 | 2,114.08 | 4,011.22 | 7,653.30 | 6,409.97 | 318.06 | 21,600.86 | 375.78 | 11,417.94 |
| Transferred to / (from) Balance of Core Grants | (32.15) | - | - | - | - | - | - | - | - | - | (32.15) | - | - | - |
| **SURPLUS / (DEFICIT)** | **14,751.66** | **1,081.84** | **368.06** | **95.68** | **74.54** | **955.01** | **292.32** | **1,488.92** | **505.83** | **3,105.72** | **57.99** | **5,066.80** | **238.69** | **1,420.25** |

## CONSOLIDATED RECEIPTS AND PAYMENTS FOR THE YEAR ENDING 31st March 2022

*Amount in ₹* *Amount in ₹*

| Receipts | 2021-22 | 2020-21 | Payments | 2021-22 | 2020-21 |
|---|---|---|---|---|---|
| **I. Opening Balance** | | | **I. Expenses** | | |
| a) Cash on hand | 2,577 | 69,638 | a) Establishment Expenses | 1,33,41,51,411 | 1,49,89,60,596 |
| b) Bank Balances | | | b) Administrative Expenses | 1,16,25,25,796 | 52,72,23,119 |
| i) In Savings/Current Accounts | 2,08,74,49,506 | 1,54,56,82,528 | c) Payment made to Creditors for Goods and Others | 4,89,16,38,514 | 1,72,28,47,030 |
| **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) | 59,44,06,335 | 30,67,70,490 |
| a) From Government of India | 1,70,98,16,607 | 1,14,24,58,673 | | | |
| b) Grant and Other Income Received for Projects | 6,84,24,61,979 | 4,83,04,29,309 | **III. Investments and Deposits made Progress** | 9,38,59,28,028 | 7,87,97,48,705 |
| **III. Income from Encashment of FDRs** | 9,71,60,91,956 | 6,45,49,15,099 | | | |
| **IV. Interest Received** | | | a) Purchase of Fixed Assets | 11,64,80,085 | 5,39,20,301 |
| a) On Bank Deposits | 42,09,20,967 | 56,50,82,094 | b) Expenditure on Capital Work in Progress | - | - |
| b) Loans and Advances | 15,29,359 | 2,33,187 | **V. Refund of Surplus money/loans** | - | - |
| **V. Other Income (Specify)** | | | **VI. Finance Charges (Interest)** | - | - |
| a) Previous years Income recovered | 30,25,843 | 17,53,964 | **VII. Other Payments (Specify)** | - | - |
| b) Advances Received from Customers | 10,37,78,946 | 74,13,76,181 | a) Deposit (Assets) | 23,37,68,008 | 20,51,22,918 |
| d) Fees/Subscription & Direct Income | 1,39,26,69,457 | 55,44,58,052 | b) Loans and Advances | 76,36,79,978 | 27,21,15,558 |
| e) Other Income | 63,45,13,414 | 62,39,60,975 | c) Previous years outstanding payments | 2,54,63,57,716 | 3,75,85,13,116 |
| f) Amount Received from Debtors | 3,07,64,86,670 | 1,74,41,76,774 | d) Prepaid Expenses | 1,89,11,283 | 2,13,07,968 |
| g) Loans and Advances Recovered | 16,38,34,503 | 20,71,36,389 | e) Branch and Divisions | 2,61,45,27,927 | 5,24,72,48,485 |
| **VI. Amount Borrowed** | | | f) Deposits (Liabilities) Refunded | 8,89,66,874 | 1,79,91,564 |
| Branch and Divisions | 2,42,16,62,154 | 4,98,86,11,308 | **VIII. Closing Balance** | | |
| Bank Loan | - | - | | | |
| **VII. Any Other Receipt (Give Details)** | | | a) Cash on hand | 8,921 | 2,577 |
| a) Deposits (Liabilities) | 10,04,65,861 | 9,91,55,438 | b) Bank Balances | | |
| b) Addition to Reserve Fund | 3,53,03,111 | - | i) In Savings Accounts | 5,03,36,62,034 | 2,08,74,49,506 |
| **Total** | **28,78,50,12,910** | **23,59,92,21,933** | **Total** | **28,78,50,12,910** | **23,59,92,21,933** |
| | - | - | | | |

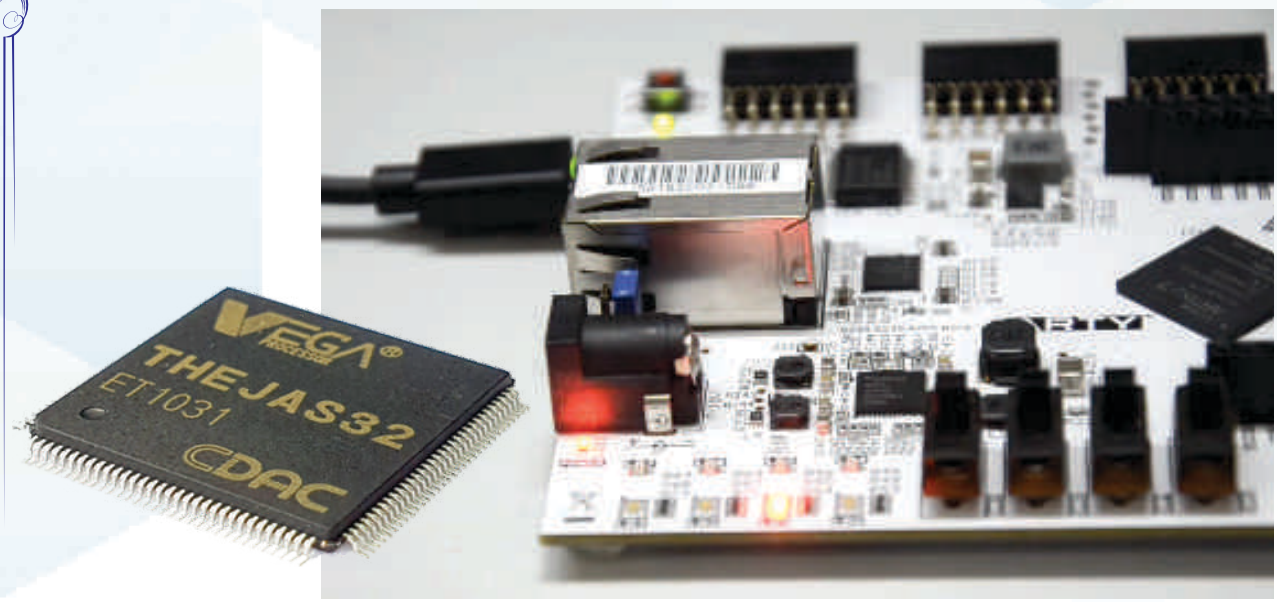
AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
**M/S. Lahoti Kasat & Co. (FRN: 105509W)**
**CHARTERED ACCOUNTANTS**

**Indira Pasupathy**
**Director Finance**

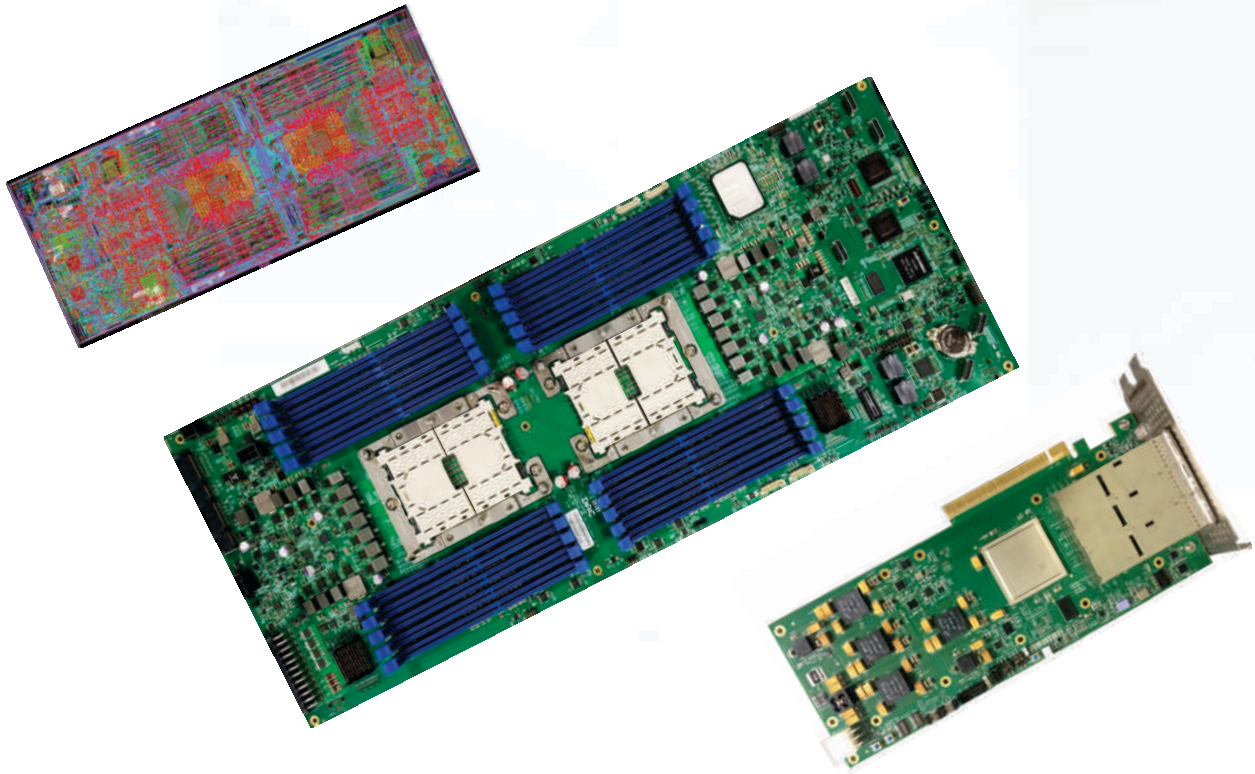
**Sunil Misar**
**Registrar (I/C)**

**Magesh Ethirajan**
**Director General**

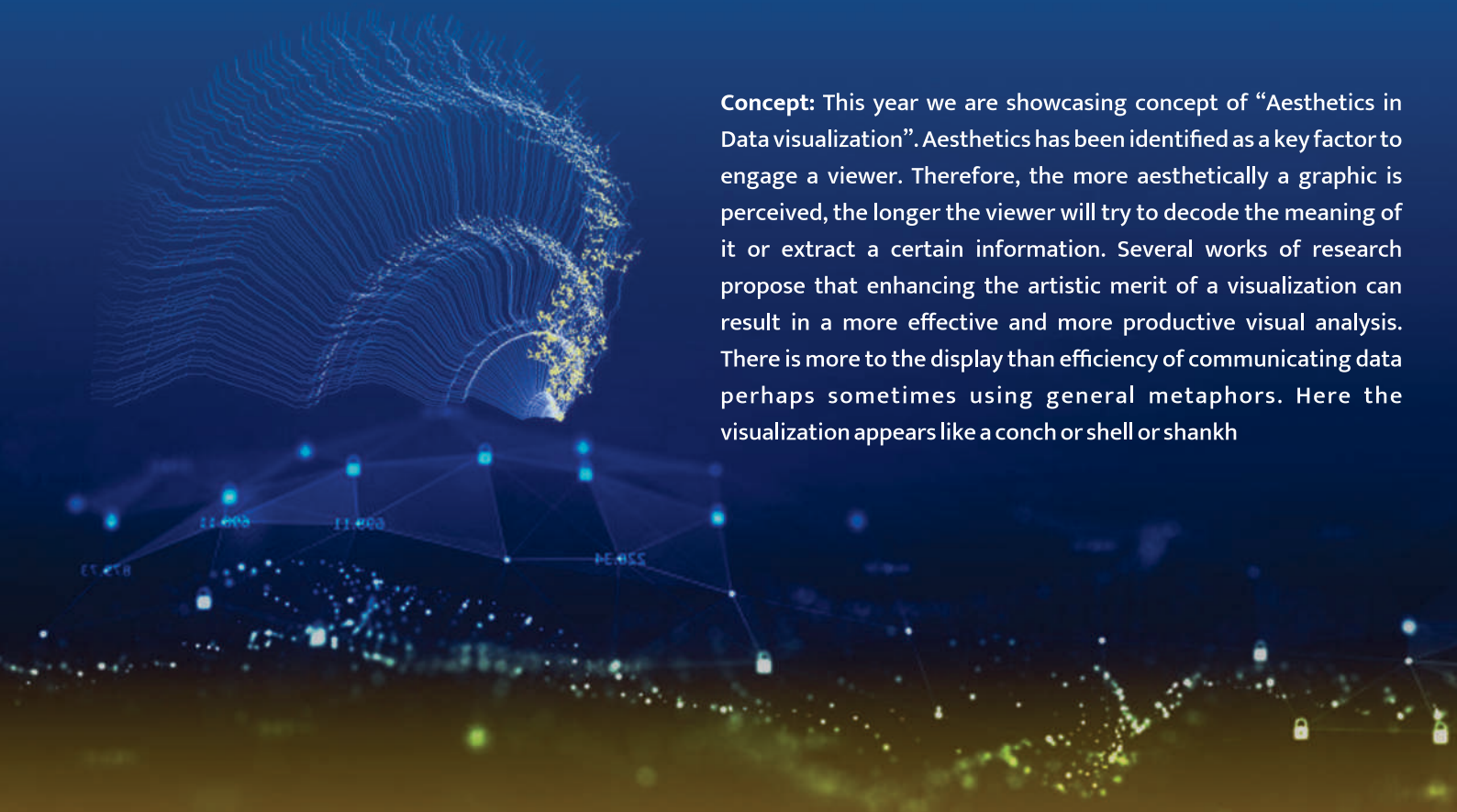
**CA Rohit Kasat**
**Partner (M.No.151410)**
**UDIN : 22151410ATZRGU6970**
**Place : Pune , Date : 22-Sept.-2022**




Vega Processor and SoC



Rudra Server Board and SoC



**Concept:** 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 conch or shell or shankh

● Bengaluru ● Chennai ● Hyderabad ● Kolkata ● Mohali ● Mumbai ● New Delhi ● Noida ● North East (Silchar) ● Patna ● Pune ● Thiruvananthapuram