ANNUAL REPORT
2023-2024

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CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

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

Governing Council

(As on 31st March 2024)

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Overview

Centre for Development of Advanced Computing (C-DAC) is the premier R&D organization of the Ministry of Electronics and Information Technology (MeitY) for carrying out R&D in IT, Electronics and associated areas. Today, C-DAC has positioned itself to be in leading position in the areas of High-Performance Computing (HPC), Quantum Computing, Artificial Intelligence, Digital India RISC-V, eGovernance, Healthcare Technologies, Cyber Security and Forensics, Power Electronics, Communication Technologies, Internet of Things and Education and Capacity building programs. During the year 2023-24, C-DAC achieved significant technological advancements, organized various events for stakeholder engagement, and received numerous recognitions. Brief of activities undertaken during the year is mentioned below.

C-DAC has deployed 17 high-performance computing (HPC) systems across three phases, boasting a cumulative compute power exceeding 28 PFLOPS. In Phase 1, systems include PARAM Shivay (838 TFLOPS) at IIT BHU, PARAM Brahma (1.7 PFLOPS) at IISER Pune, and PARAM Shakti (1.66 PFLOPS) at IIT Kharagpur. Phase 2 saw the installation of twelve systems: PARAM YUKTI (1.8 PFLOPS) at JNCASR Bangalore, PARAM Siddhi-AI (210 AI PFLOPS / 5.2 PFLOPS) 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 NAABI Mohali, PARAM Seva (838 TFLOPS) at IIT Hyderabad, PARAM Ganga (1.66 PFLOPS) at IIT Roorkee, 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. Phase 3 introduced PARAM Rudra (3.0 PFLOPS) at IUAC Delhi and an AI system (50 AI PFLOPS / 1.3 PFLOPS) at NIC Delhi. These systems support the computational needs of academia, researchers, MSMEs, and startups in areas of national and strategic importance.

A significant portion of the components for Phase 3 systems under National Supercomputing Mission (NSM), including Rudra servers and the HPC Software Stack, were designed, manufactured, and assembled domestically. The systems support a wide range of applications such as SimInu - a geospatial portal, GeoSevak - Online Geospatial Transaction System, Simulation Lab and Science Based Decision Support Framework, CFD Model for pollution dispersion, SeisRTM- software suite for seismic imaging to aid oil and gas exploration, etc. They are accessed via the National Knowledge Network (NKN) by over 8,100 researchers and academicians from more than 224 institutes nationwide. To date, 1,400+ Ph.D. research scholars have executed over 9.3 million jobs on these systems, resulting in the publication of 1,200+ research papers in highly reputed journals both in India and internationally.

Under Digital India RISC-V (DIR-V) program, C-DAC has successfully designed and developed the VEGA series of microprocessors, including India's first indigenous 64-bit multi-core RISC-V based Superscalar Out-of-Order Processor. The VEGA series, which consists of six 32/64-bit single/dual/quad-core superscalar out-of-order high-performance processor cores, matches the performance of commercially available processors and is suitable for strategic, industrial, and commercial applications. Several SoC chips integrating the VEGA processors are in development, including the successfully fabricated 32-bit single-core SoC (THEJAS32), and the taped-out 64-bit single-core SoC (THEJAS64), at the Indian foundry SCL, Chandigarh. Additionally, a development platform based on the

THEJAS32 ASIC, named ARIES, has been created. These fully indigenous boards are designed for learning, embedded system design, and IoT applications, complete with Board Support Packages, SDK with integrated toolchain, IDE plug-ins, Debugger, and support documentation. Shri Alkesh Kumar Sharma, Secretary, Ministry of Electronics and Information Technology (MeitY), Government of India, unveiled the innovative ARIES DOT development board targeted for wearable devices at Thiruvananthapuram on August 10, 2023.

The Design Linked Incentive (DLI) Scheme aims to provide financial incentives as well as design infrastructure support across various stages of development and deployment of semiconductor design for Integrated Circuits (ICs), Chipsets, System on Chips (SoCs), Systems & IP Cores and semiconductor. As on March 2024, a total of 38 applications were received for financial support under DLI and 29 applications were received for access to the EDA Tools from the National EDA Toolgrid setup at ChipIN centre.Union Minister of State for Electronics and IT, Skill Development, Entrepreneurship and Jal Shakti, Shri Rajeev Chandrasekhar launched the 3rd SemiconIndia futureDESIGN Roadshow at IIIT Delhi on May 12, 2023 and inaugurated India's first FutureLABS center in C-DAC Thiruvananthapuram on March 12, 2024. Under Chips to Start-up (C2S) Programme Support - 100 Institutes, 13 Start-ups/ MSMEs are supported financially, Various FPGA boards identified and recommended by the CEPC were procured and distributed to all 100 participating institutes under C2S Programme, and More than 200 organizations are supported for the EDA tool support including institutes supported for funds.

C-DAC has launched Quantum Labs - QuBIT Studio in Bangalore, and the Quantum Technology Lab in Pune, which are dedicated to advancing quantum technologies. QuBIT Studio focuses on hybrid computing systems and the Quantum Technology Lab featuring a clean room for quantum communication and control electronics research. C-DAC has developed QuIPs (Quantum Computing Control IPs) - control hardware for quantum computing, compatible with range of peripherals for seamless integration with existing frameworks and software. As a part of Metro Area Quantum Access Network (MAQAN), IITM, SETS, ERNET and C-DAC has implemented India's first QKD network as a 5-node network at Chennai spread over a distance of ~11.5 km which provides a testbed to experiment on different QKD protocols.

Artificial Intelligence is one of the focus areas of C-DAC in which various activities have been carried out which includes - Development of Authorship Attribution Methods for Forensics Applications, OCRs and Applications in Indian Languages, Indian Language to Indian Language Machine Translation System (IL-ILMT), A Brain Machine Interface enabled Assistive Communication System for Persons with Special Needs, A Multi-Modal Neuro-Physiological Framework for Behaviour Analysis, iMedDesk - AI Assisted Healthcare Services Framework.

C-DAC is associated with ISRO in developing and supplying indigenously developed technologies for qualification tests of various stages of the ISRO mission programs including Chandrayaan and Aditya-L1mission. C-DAC has deployed VETRA-NEO, an advanced Differential Global Positioning System (DGPS) positioning system equipped with a multi-frequency GNSS receiver and a high quality UHF radio modem deployed by Indian Navy at Under Water Ranges at Goa. During the year, as a part of Emergency Support Services (ERSS), Child Helpline Solution was deployed in 36 States/UTs and 470 district centres and the Women Helpline Solution was deployed in 29 States/UTs and 230 district centres.

During the year, C-DAC has developed and deployed several software solution and services. This includes, COPS Netra, an auditing tool that streamlines and automates asset verification and audit processes, SAMPADA - a deviation settlement mechanism accounting software for bill payment and settlement at the Western Regional Load Dispatch Centre (WRLDC). Other initiatives include BOSS-Based Student Assessment Solution, an advanced tool for assessing

student proficiency, Language Data Digitization and Repository System for data analytics and visualization, Transliteration and Name Matching Software for MAHAIT and ORGI. C-DAC has also developed, Kanthasth 2.0 - a software-aided translation system. The Centre of Excellence in Intellectual Property, is serving a diverse community of over 25,000 registered users, including innovators, startups, and MSMEs.

C-DAC has implemented various eGovernance projects and solutions including wood-based industry licensing system, robust communication frameworks like the Notify system which is currently deployed under the Ministry of AYUSH, Alert system to monitor the civil works, at Bihar Vikas Mission, Government of Bihar. Furthermore, C-DAC has introduced innovative initiatives in blockchain technology, such as the Bale Identification and Traceability System (BITS) developed for the Cotton Corporation of India. C-DAC has also contributed to Aadhaar based platforms and services, including Aadhaar Authentication & e-KYC Platform and Aadhaar Data Vault, ensuring secure storage and authentication of sensitive information for the intended entities.

During the year, C-DAC's initiatives have advanced health technology significantly, exemplified by initiatives like eSanjeevani-National Telemedicine Service and e-Sushrut HMIS, implemented in numerous health facilities nationwide, including railways and AIIMS institutions, demonstrating its robust scalability and impact in public health management. Other solutions deployed by C-DAC include e-Aushadhi – Drugs and Vaccine Distribution Management System, eRaktKosh (Centralized Blood Bank Management System), e-Upkaran (Equipment Maintenance & Management System - EMMS), etc. C-DAC has also developed Free and open-source (FOSS) toolkits and SDKs for easy integration of Digital Health Standards to achieve interoperability between health systems and programs within the country.

C-DAC has also developed various eLearning systems and solutions including OLabs NextG: Next Generation Online Labs (OLabs) and GLAMS: Gamified Learning Assessment Management System. C-DAC has also established Real-Time Cyber Security Scenario-based Self-Paced Learning Training Facility (Cyber GYAN) for SC, ST, and Economically Weaker Section students and BOSS Based Student Assessment Solution. C-DAC has conducted online Examination and Result Processing System for Indian Air Force, Indian Coast Guard, Indian Navy, Rajasthan Housing Board, ICMR, AIIMS Rajkot, NIOS, Andaman and Nicobar Administration etc.

A suite of products has been developed by C-DAC in area of Cyber Security and Cyber Forensics. This includes, CDACSIEM (C-DAC Security Information and Event Management), Rakshak DNS - a safe, secure, protective DNS resolver, Cyber Threat Management System (CTMS), FakeCheck (Deepfake Detection System), etc. Automation tool for performing static and dynamic analysis of mobile applications was launched by Shri. S Krishnan IAS, Secretary, MeitY, Government of India on February 02, 2024 at C-DAC Hyderabad.C-DAC has also been providing cyber forensic services to various Law enforcement agencies which includes StegScan V2.0 - a Digital forensic analytical tool, ANETRA SDK - software solution supporting REpresentational State Transfer (REST) Application Programing Interface (API), TrusToken – DSC (Digital Signing Certificate) Token Hardware, InTrust - asset, traffic and automatic vulnerability assessment system for Zero Trust Network.

Public transit solutions for smart mobility, Vehicle priority & road safety solutions, Autonomous Robots for agriculture, Smart vision sensors are various areas under Automotive technology that C-DAC has worked during last year. NCMC and QR Compliant Automatic Fare Collection (AFC) System for Metro Operators, FlexiFleet -Vehicle Tracking and Fleet Management System, The Personalized Transit Route Guidance System (PTRGS), Onboard Driver Assistance and Warning System (ODAWS), 5G C-V2X Platform for On-Road Vehicles (PROVE), AI-powered thermal sensor-based smart camera designed for road traffic are some of the technologies developed.

As a part of National Mission on Power Electronics Technology (NaMPET), which focuses on advancing indigenous R&D, deployment, and commercialization of power electronics technologies in India, C-DAC has worked on Wide Band Gap (WBG) technology applications for power conditioners and high-performance sensors, Vehicle Control Unit (VCU) powering over 1700 trains nationwide, smart energy meter deployment, Planar magnetic Components, etc. C-DAC has established Centre of Excellence (CoE) for Li-ion cell-based products at Noida which aims to bolster local electronic manufacturing, supported by infrastructure and R&D facilities for product design, development, and testing.

In the area of Communication Technologies, C-DAC received an order for Software Licences for 14 sets of C-DAC TETRA Network (CTN) products, which are already under ToT / Licensing, from the industry partner. C-DAC has also upgraded the RF front end of XTBS in order to support 800 MHz bands (806-824 & 851-869 MHz) as well, while retaining the rest of the architecture identical to that of the previous variant of Xtreme TETRA Base Station (XTBS) which is the flagship product.

C-DAC's single-phase energy meter, Agnivesh - the early fire alarm, battery monitoring system and water meter are few solutions developed by C-DAC in the area of IoT which are helpful in making Indian homes and cities smarter. Efforts have also been initiated in developing components (like speed controllers for PMBLDC motors for drones) and autonomous UAV based solutions like plant-health estimation for agriculture.

Various activities in the areas of Capacity building, Skill Development, Training and Education have been carried out by C-DAC. Shri Alkesh Kumar Sharma, Secretary, Ministry of Electronics and Information Technology (MeitY), Government of India, launched FutureSkills Prime portal for MeitY on June 19, 2023. FutureSkills PRIME, Swayaan, Work Based Learning are some of the notable initiatives of MeitY and C-DAC undertaken during the period. C-DAC has conducted the IT training programs for personnel of Government sectors, Indian Armed Forces, IT companies, Insurance, Energy sector, Municipal corporations, Indian Railways, Town Planning and Commissions, Authorities along with various Ministries and Departments.

The activities steered during the year 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 2023-24.

Major Activities in Thematic Areas

High Performance Computing (HPC)

C-DAC has been at the forefront of designing, developing, and deploying High-Performance Computing (HPC) systems in India. Its work encompasses indigenous research and development in various HPC components, including processors, server boards, interconnects, clusters, and cooling systems. C-DAC also excels in creating HPC system software, applications, solutions, and services. C-DAC has contributed to advancing India's supercomputing capabilities in infrastructure, applications, research and development, and human resource development.

Key Activities in High Performance Computing

HPC Hardware Components : C-DAC is focused on the research and development of various high-performance computing (HPC) hardware components. This includes design and development of efficient processors, server boards, interconnects, clusters, and cooling systems, all aimed at enhancing the performance and efficiency of computing systems.

HPC Software Components : C-DAC is also dedicated to developing specialized software stacks and system software tailored for HPC systems. This includes parallel programming frameworks, compilers, schedulers, and other essential software elements that optimize and enhance the functionality and performance of HPC systems.

HPC Applications : C-DAC develops applications designed to fully leverage the computational power of supercomputers. These applications span a wide range of scientific, engineering, and research domains, tackling complex, computationally-intensive problems effectively.

HPC Solutions and Services : Providing comprehensive HPC solutions and services is a core activity. This includes offering consultation, deployment, maintenance, and support services for HPC systems, helping users and institutions achieve advanced computing capabilities.

Petascale Computing Systems : C-DAC is actively working on developing Petascale computing systems capable of performing computations at the level of petaflops (quadrillions of floating-point operations per second). These systems represent a significant leap in supercomputing capabilities and will provide substantial advancements in computational power.

Human Resource Development : Under the National Supercomputing Mission (NSM), there is a goal to develop 20,000 HPC-trained personnel over the mission's duration. These professionals are envisioned to manage, monitor, and operate complex HPC systems. This initiative is driven by the NSM Expert Group on Human Resources Development (NSM-EG-HRD), focusing on building a skilled workforce for the future of supercomputing.

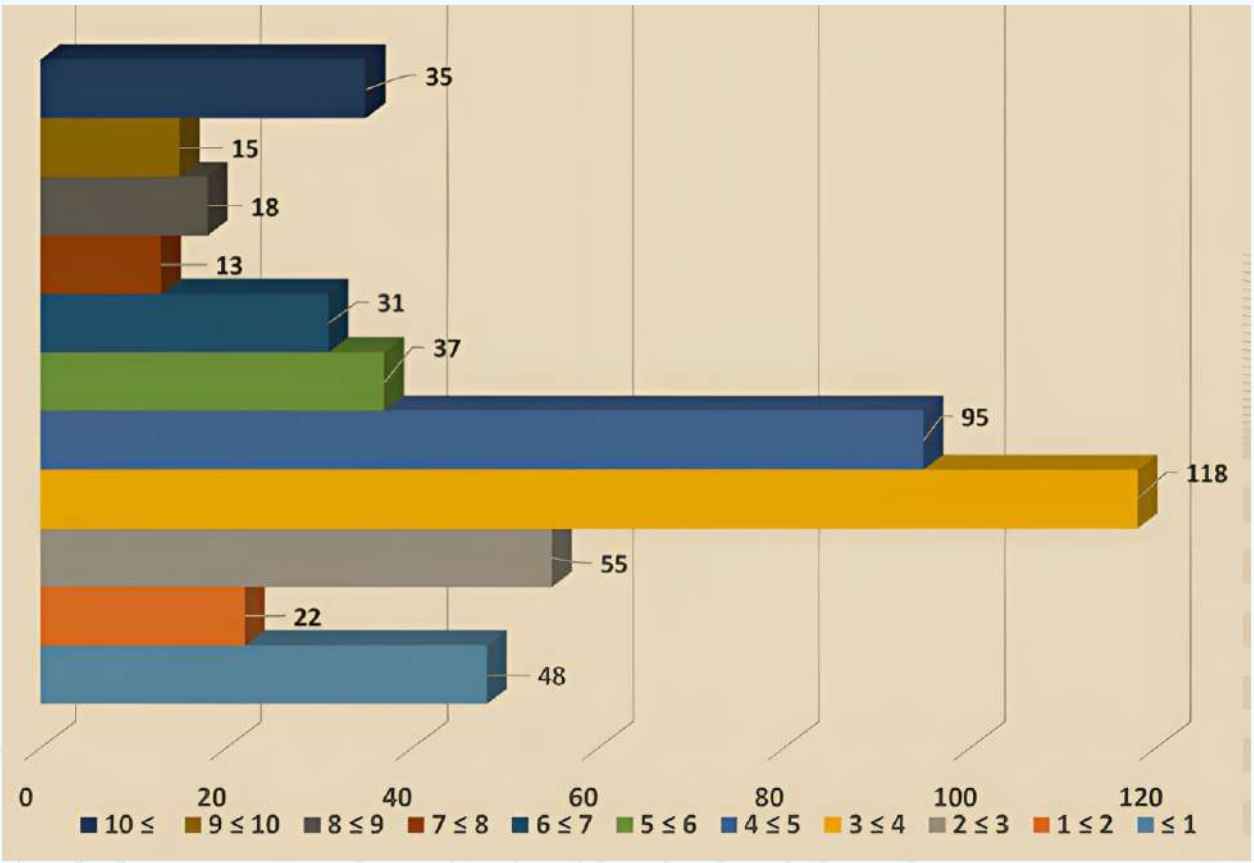
National Supercomputing Mission (NSM)

Under National Supercomputing Mission (NSM), approved in 2015 by Cabinet Committee on Economic Affairs (CCEA), C-DAC has been engaged in design, development and deployment of Petascale High-Performance Computing (HPC) systems encompassing indigenous R&D in HPC Components viz. processor, server board, interconnect, cluster, cooling system), HPC System Software, HPC Applications, and HPC Solutions and Services. A brief on activities carried out by C-DAC during 2023-24 in this thematic area under NSM is given herein.

HPC Systems, Facilities and technologies

C-DAC has been developing HPC systems targeted at Exascale ecosystem in phased manner: from "Assembly" to "Manufacturing" to "Design and Manufacturing" of HPC systems. NSM aims at Atmanirbhar Bharat in supercomputing for undertaking investigation by scientific-engineering community of the country. It plans to build and deploy 25 facilities with cumulative compute power of 64 Petaflops.

Till March 2024, C-DAC has deployed 17 systems at under Phase-1, Phase-2 and Phase-3 with a cumulative compute power of 28+ PFLOPS. Three systems comprising of PARAM Shivay (838 TFLOPS) at IIT BHU, PARAM Brahma (1.7 PFLOPS) at IISER Pune and PARAM Shakti (1.66 PFLOPS) at IIT Kharagpur under Phase-1, twelve systems comprising of PARAM YUKTI (1.8 PFLOPS) at JNCASR Bangalore, PARAM Siddhi-AI (210 AI PFLOPS/ 5.2 PFLOPS) 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 NAABI Mohali, PARAM Seva (838 TFLOPS) at IIT Hyderabad, PARAM Ganga (1.66 PFLOPS) at IIT Roorkee, 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 under Phase-2 and two systems comprising of PARAM Rudra (3.0 PFLOPS) at IUAC Delhi and an AI system (50 AI PFLOPS/ 1.3 PFLOPS) at NIC Delhi under Phase-3 are operational. These systems cater to computational demands of academia, researchers, MSMEs, and startups in areas of national and strategic importance.



Research publications along with impact factor range

A significant number of components (including Rudra servers and HPC Software Stack) in building Phase-3 systems are designed, manufactured and assembled within the country. A wide range of applications from scientific & engineering and data science domains are optimized and scaled for underneath processor. These systems are accessed by 8100+ researchers, academicians from 224+ institutes across the country on National Knowledge Network (NKN). 93+ Lakh jobs have been executed till date by 1400+ Ph.D. research scholars who have published 1200+ research papers in leading journals in India and overseas of very high repute and impact factor (exceeding an impact factor of 10 in some cases), such as Nature, Journal of Physics: Condensed Matter, Nuclear Physics, IEEE Transactions, The Journal of Physical Chemistry, Applied Surface Science, Journal of Environmental Chemical Engineering, Journal of Biomolecular Structure and Dynamics, Journal of Environmental Chemical Engineering.

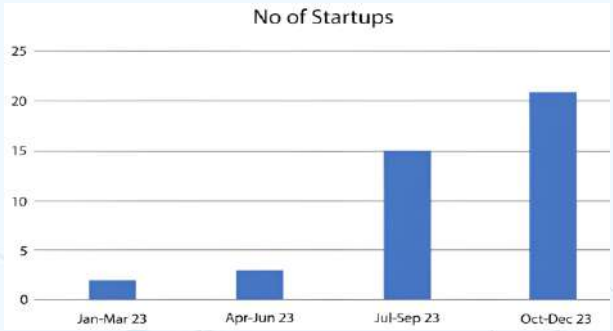
AI Research Analytics and Knowledge Dissemination Platform (AIRAWAT-PSAI)

C-DAC has realized AI Research Analytics and Knowledge Dissemination Platform - PARAM Siddhi -AI (AIRAWAT-PSAI) of 410 AI PFLOPS. It acts as a computational cloud for Big Data Analytics and Assimilation with a large, power-optimized AI cloud infrastructure connecting institutions with NKN.

AIRAWAT-PSAI

AIRAWAT-PSAI was ranked at No. 75 in the 61st edition of 'TOP500 Supercomputer List – June 2023' and declared during International Supercomputing Conference 2023 (ISC 23) at Germany.

AIRAWAT-PSAI was leveraged by C-DOT to identify issuance of 2.25 lakh benami SIM cards across the state of Gujarat. Identities of 15,000 unsuspecting citizens were being misused. The effort was extended to states of West Bengal (over 12.34 lakh SIMS), Haryana (over 5.24 lakh SIMs), Bihar and Jharkhand together (over 3.27 lakh SIMs), Madhya Pradesh (over 2.28 lakh SIMs) and Uttar Pradesh East (over 2.04 lakh SIMs). These efforts helped in ground level operations by state law enforcement agencies. AIRAWAT-PSAI was also used by NLTM (Mission Bhashini) to develop India specific language models for ASR, TTS, STS etc. More than 90 models have been trained so far using AIRAWAT-PSAI by 140 users. AIRAWAT-PSAI has been used by increasing number of startups during 2023 which signified its use and relevance.



Quarterly number of start-ups during 2023

PARAM Shavak : PARAM Shavak provides 'supercomputing solution in a box' for scientific, engineering, and academic programs to catalyze research using modeling, simulation, and data analysis. During 2023-24, seventeen (5 in India and 12 in Bangladesh) PARAM Shavak systems were deployed at CME at Pune Dr. Babasaheb Ambedkar Marathwada University at Aurangabad, Trident Academy of Technology at Bhubaneswar, School of Computer Engineering & Technology, Dr Vishwanath Karad MIT World Peace University at Pune, and at Bangladesh.

In 2024, C-DAC launched PARAM Shavak, powered by the Rudra platform, a tabletop model similar to a desktop. It is equipped with two multicore processors and a software stack consisting of both indigenous and open-source software. It is available in several variants: PARAM Shavak HPC for high-performance computing applications, PARAM Shavak DL-GPU for ML-DL and AI applications, PARAM Shavak VR for manufacturing and healthcare applications, and PARAM Shavak Srushti for agricultural bioinformatics applications. It is planned to be manufactured in India by VVDN Technologies Pvt Ltd under Government's Make in India concept and empowered by indigenously developed BOSS operating system and software ONAMA and CHReME.

The launch marks a significant milestone in India's journey towards self-reliance in HPC. C-DAC's expertise in supercomputing ensure that it meets international standards of performance and reliability. The cutting-edge manufacturing facility of VVDN Technologies played a crucial role in bringing this advanced computing solution to fruition, underscoring the collaboration between research and industry in driving technological advancements.

Build Approach Development under NSM

Indigenous Rudra-I server : C-DAC's Rudra-I server is targeted for Hyperscale Data Centers in addition to HPC, Cloud, edge computing and communication. Phase-3 systems of NSM are being developed using Rudra-I server. In 2023, C-DAC signed contract with VVDN for production of 6000 Rudra-I servers. In March 2024, C-DAC signed contract with M/s Kaynes as one more partner for production of Rudra-I server for accelerating the production for Phase-3 systems of NSM. The first system under Phase-3, PARAM Rudra at IUAC is built and commissioned using Rudra servers designed and manufactured indigenously. C-DAC has partnered with M/s VVDN, M/s Kaynes technologies and M/s Avlon with technology transfer of server design for proliferating Rudra servers. HPE, in partnership with VVDN, has decided to manufacture servers in India. The next series of desktop supercomputers 'Param Shavak' has been designed around Rudra server boards.

C-DAC continues to work on Rudra 2.0 server with Intel. RUDRA 2.0 is based on Intel's 4th and 5th generation Xeon Scalable Processor (Sapphire Rapids, Emerald Rapids). It supports 1/10G Ethernet, HDR/NDR NIC slot, SSD/SATA. It is designed with effective thermal design to support up to 350W TDP processor.

Rudra 1.0 server

Indigenous Rudra-AMD server : C-DAC is also working on developing Rudra-AMD server based on AMD 5th generation CPU and GPGPU, which is aimed at mastering both HPC and AI workloads. This OCP ORv3 inspired server is a Dual socket AMD EPYC9654 'Genoa' and UBB hosting octa-MI300X based OAMs. This 8 OU, Air cooled server supports OCP NICs up to 400G, NVMe/SATA, and DC-SCM2.0 for security and management. The design and development of this server is being done at C-DAC in collaboration with VVDN Technologies and Applied Materials India Pvt. Ltd.

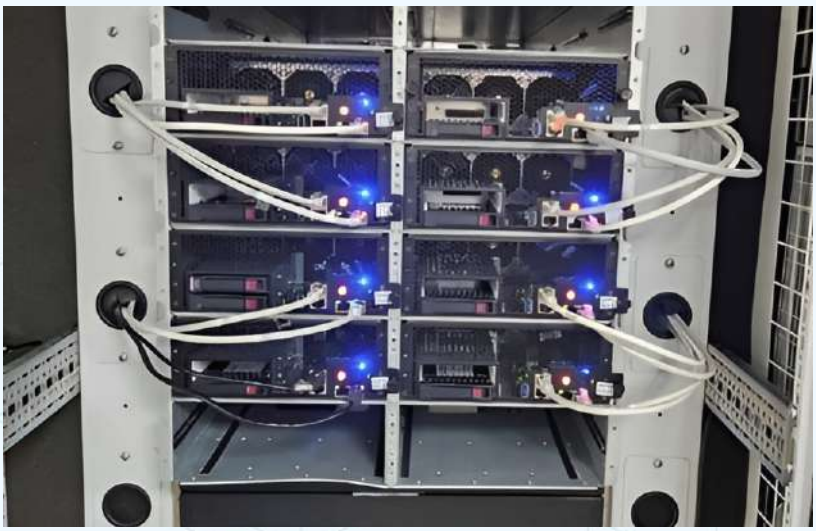
Indigenous HPC Network – Trinetra : C-DAC's Trinetra interconnect development is aimed at Exascale network design for scalability to hundreds of thousands of compute nodes without need for dedicated switching hardware. It encompasses chip design (NCC - Network Controller chip), Platform design (PCB development), and Lightweight Protocol networking software design. Development is split into multiple phases, with Trinetra-A phase reached product deployment stage.

Trinetra-A, a fourth-generation network, is an interconnect of 600 Gbps (100Gbps*6) throughput and supports 3D Torus network topology for HPC. Several hardware and software components realize high bandwidth, low latency, scalable network fabric supporting industry-standard programming interfaces. Trinetra-A was launched on April 02, 2022 by Shree Rajeev Chandrasekhar, Hon'ble Minister of State. It is deployed in C-DAC's PARAM Rudra 1PF pilot system at C-DAC, Pune.

Trinetra-A NIC

Trinetra-B

Trinetra-B is based on PCI-e Gen3 host interface. It is designed using 200Gbps physical link layer technology and uses 10 links to realize 'Supercluster' topology. Aggregate throughput from Trinetra-B physical link layer is 2 Terabits/sec, full duplex. PARAM Trinetra is established at C-DAC, Pune based on Trinetra-B interconnect.



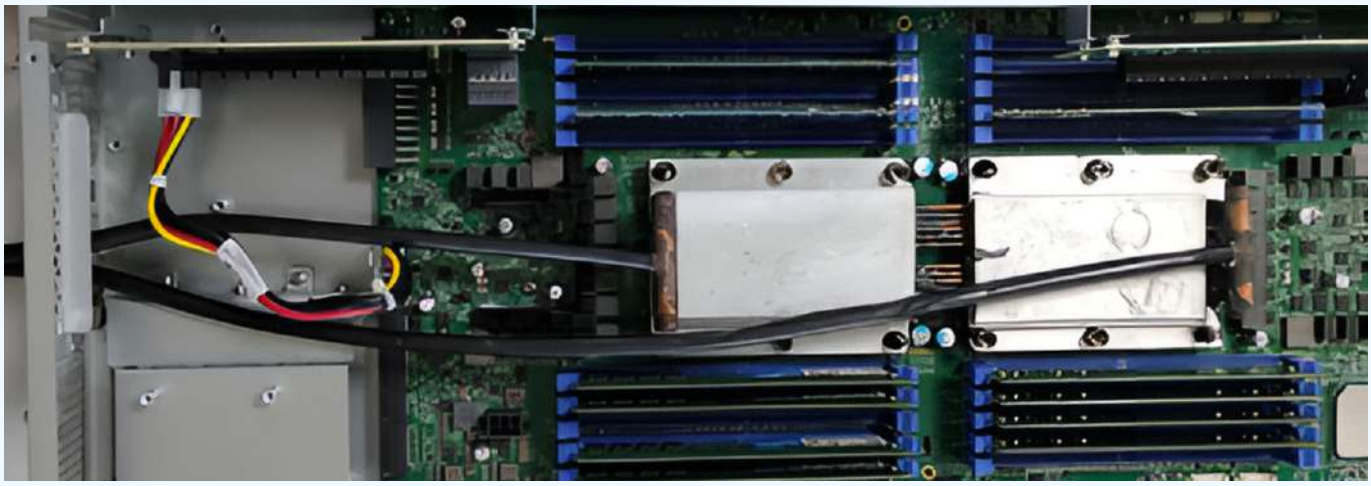
PARAM Trinetra

Indigenous HPC Processor SoC (AUM) : Keeping an alignment with the "Aatmanirbhar Bharat" initiative of Government of India, for complete indigenization of HPC System development, C-DAC is developing an indigenous HPC Processor SoC (AUM) based on Arm Neoverse V2 architecture in TSMC 5nm technology node. The indigenous HPC Processor SoC AUM will have 96 Cores,128 GB of HBM3 memory, 16-DDR5 channels and 128-PCIe Gen5 lanes. It will provide ~5 TFLOPS performance at ~300 W TDP and will enable future HPC Systems development with best-in-class HPCG benchmark figures in the industry.

C-DAC has collaborated with the consortium of M/s. MosChip Technologies, India and M/s. Socionext Inc., Japan for design & development of this indigenous HPC Processor SoC AUM. The AUM processor chip will be taped-out in December 2025 and tested samples will be available in December 2026.

Indigenous Processors based on RISC-V ISA : In line with Government of India's vision of "Achieving total self-reliance in supercomputing", C-DAC is now engaged in development of server class indigenous CPU, GPGPU, AI/ML accelerator, and Hybrid SoC based on open-source RISC-V ISA. This activity is taken up as pre-cursor to NSM 2.0, wherein development of indigenous server platforms for HPC & AI based on these RISC-V processors, Indian BIOS, Indian OS, complete RISC-V software ecosystem, and 5PF pilot clusters for HPC and AI based on the indigenous RISC-V server platform are envisaged. Micro architecture for GPGPU and AI/ML accelerators have already been developed. Micro architecture development of CPU is in progress. All the proposed processors would be proven on FPGA by the end of NSM 1.0, i.e., December 2025.

Direct Contact Liquid Cooled (DCLC) System : A Coil-on-Chip Liquid Cooling System is designed, optimized using CFD and fabricated to extract heat load up to 360 W followed by 330 W (165 W from each processor) to cool Rudra server board. The 330 W chip cooler was tested in standalone mode and its thermal performance was found satisfactory. Same has been packaged and integrated with Rudra server.

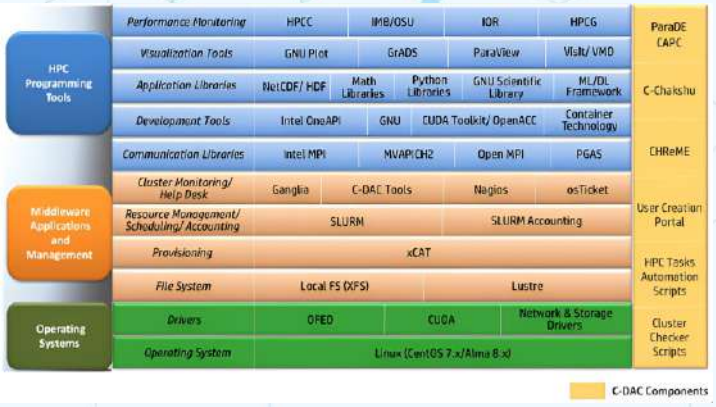


330 W coil on chip-based cooling system for Rudra Server

Special Purpose Computer for Molecular Dynamics (SPC-MD) Simulation: Architecture Exploration : Multi-FPGA 3D FFT hardware design has been integrated with GROMACs. It met target frequency of 195 MHz. It has completed extensive verification targeted for 195 MHz. It works on both U200 and U250 boards.

HPC System Software

C-DAC's HPC software Stack (CHCS) : C-DAC's HPC software Stack (CHCS) is built upon a customized OSS framework, enriched with value-added tools, technologies, and scripts. It streamlines systematic building, deploying and managing HPC and AI based systems.



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

C-CHAKSHU [v3.0] : C-Chakshu offers a centralized web-based dashboard providing unified view of all NSM systems across geographically diverse locations nationwide. It enabled administrators to set customizable thresholds and receive real-time notifications when specific conditions are met or exceeded.

CHReME [v4.0] : CHReME seamlessly integrates with various schedulers or Workload Managers such as SLURM, Torque, OpenPBS, Sun Grid Engine, Moab and Load leveler, eliminating the need to learn command line interface.

HPC Tutor [v1.5] : An interactive learning platform presents a unified web page, merging comprehensive presentation materials seamlessly with direct shell access to HPC clusters.

User Creation Portal [V2.1] : It streamlines account creation process by automating data collection and eliminating manual paperwork. It also enhances transparency by enabling users to monitor the progress of their requests and receive timely updates via email.

CAPC [v3.0] : CAPC provides a solution for automatically parallelizing sequential codes to parallel codes for execution on different types of target parallel hardware. It supports automatic parallelization of C, C++ and Fortran codes to OpenMP, OpenACC and OpenCL.

ParaDE [v2.0] : It is an IDE for hybrid parallel application development providing ease-of-use of HPC and mobility to users and data. It supports C/C++, Fortran and mixed language support (C with Fortran) with OpenMP and MPI, CUDA, OpenACC, and Sycl. It supports appropriate tools of debugger, profiler, third-party library support and automatic converter required for application development.

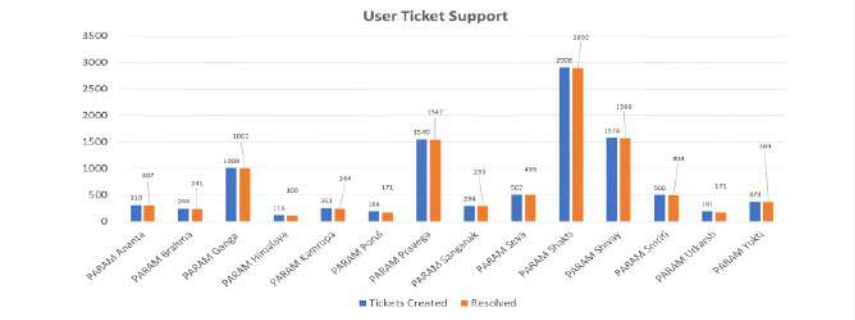
C-DAC HPC Application Profiler (CHAP) [v1.0] : CHAP identifies hotspots and bottlenecks in an application with suggestions for developers to potentially improve the application's performance for HPC cluster.

C-DAC Compiler TUI : It is a Text User Interface (TUI) for people interested in trying out GCC and LLVM compilers and for those learning about the different optimization passes available in these compilers.

HPC CSOC : HPC Centralized Security Operations Centre monitors traffic of supercomputing facilities to improve Security posture while proactively detecting, analyzing and responding to the threats.

Param Utkarsh Service Portal (PUSP) : PUSP provides a bird's eye view of functionalities and services of Param Utkarsh HPC ecosystem, job submission interface with ready-to-use application templates, self-explanatory and intuitive UI helping end-user with ease-of-use experience.

OS Ticketing Tool [v2.0] : It seamlessly integrates inquiries/support created via email and web-based forms into a simple easy-to-use multi-user web interface.



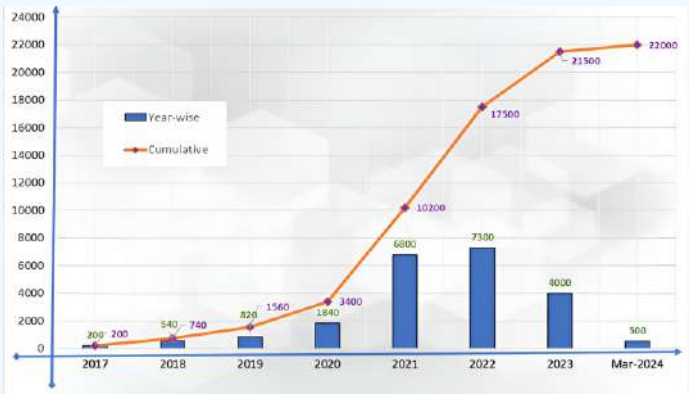
User Ticket Dashboard

Unified Programming Ecosystem (ParaS) : C-DAC's long-term vision is to establish a robust software ecosystem that allows applications to be developed once and deployed across any hardware platform. This initiative significantly reduces the complexity and effort associated with porting applications, streamlining the development process. In line with the vision, C-DAC has designed and developed a Unified Programming Ecosystem (ParaS) to enable seamless portability of source codes and applications across multiple platforms and hardware vendors in High-Performance Computing (HPC). C-DAC has successfully released a compiler for ParaS, built on the SYCL 2020 specification. This compiler enables the execution of a single source code on all major CPUs (Intel, AMD, ARM, and IBM) and GPUs (NVIDIA and AMD) without any modification.

C-DAC's Unified Programming Ecosystem- ParaS

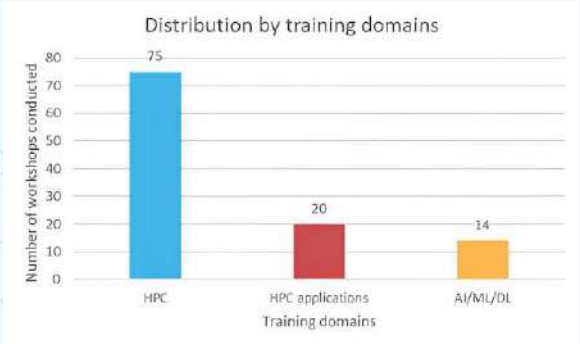
PINAKAA Studio : It is the optimized System Software Stack of C-DAC targeting the indigenous hardware. PINAKAA Studio targets both the servers and the clusters for HPC. The stack includes base system software, middleware for HPC, domain-specific application software, open-source, and in-house developed HPC software. Currently, the PINAKAA Studio is being built for the C-DAC's indigenous servers based on AMD, AUM, and RISC V architectures.

NSM Human Resources : C-DAC conducted PG diploma in HPC System Administration under NSM during March 2023 – August 2023 and September 2023 – February 2024. Under NSM, 22,000+ next generation of HPC aware manpower trained till date, comprising students, researchers, and faculties through FDPs, Workshops, Bootcamps, and Hackathons.



Year-wise HPC Aware Manpower Trained

Category wise workshops conducted



Distribution by training domains

Following activities were carried out during 2023-24:

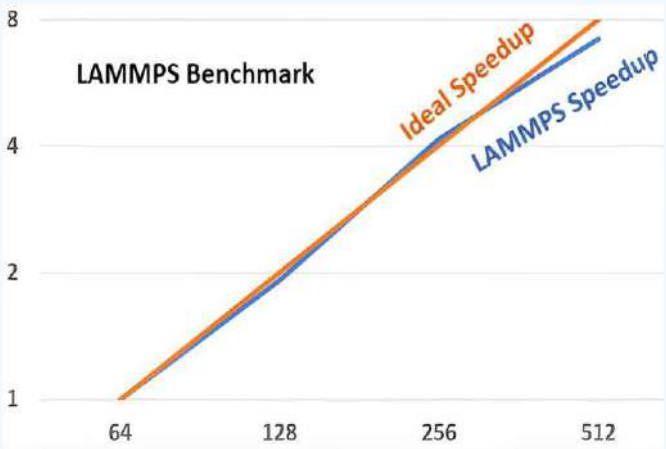
- Training School on WRF Modeling System during April, 2023
- Introductory Workshop on High Performance Computing (SRTMUN) during April, 2023
- HPC Workshop at NIT Trichy during May, 2023
- GPU BOOTCAMP in association with SERC, IISc and Nvidia during May, 2023
- NSM-Nvidia Domain Specific Training during August, 2023
- HPC Awareness Workshop - NIT Trichy during September, 2023
- oneAPI online AI Hackathon (Intel) during July - Sept, 2023
- NSM HPC/DL Awareness Bootcamp - IIT Roorkee during October, 2023
- Eshan College of Engineering during October, 2023
- NSM HPC/DL Awareness Bootcamp - NIT Trichy during November, 2023
- NSM HPC/DL Awareness Bootcamp - IIT Mandi during December, 2023

Bootcamps were conducted to enhance HPC awareness, improve resource utilization, and address potential issues faced by researchers, at IIT Roorkee, NIT Trichy and IIT Mandi. They encompassed a) identification of problem statements and areas of concern; b) conduct of sessions to increase system awareness, familiarize users with the application stack on the system, and provide guidance on system usage; c) one-on-one interactions to resolve potential issues specific to each user and implementation of feedback system to gather input for improvements.

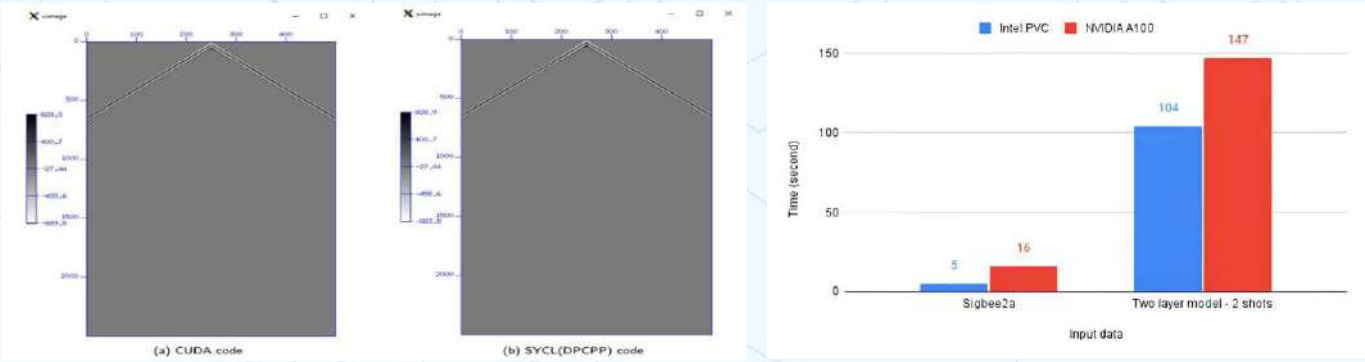
A MOU is planned to be signed with AICTE to proliferate HPC knowledge to students studying in institutes affiliated to AICTE, under which Master Training Programs were conducted to train master trainers who in turn will conduct FDP in institutes across country for undertaking HPC related courses in curriculum to students (SANKLAP).

Application Porting, Optimization and Scaling services : 300+ applications/ libraries/ tools in MD, CFD, weather prediction, material science, computational chemistry, bioinformatics, physics, ML, DL, and other domains were deployed on HPC systems using Spack, a tool to create a robust Exascale software ecosystem. System acceptance tests were conducted at multiple NSM sites.

PARAM system at IUAC was benchmarked with one strong scaling (LAMMPS) and one weak scaling application (WRF). Efficiency of 90% and 73% was achieved with LAMMPS and WRF.

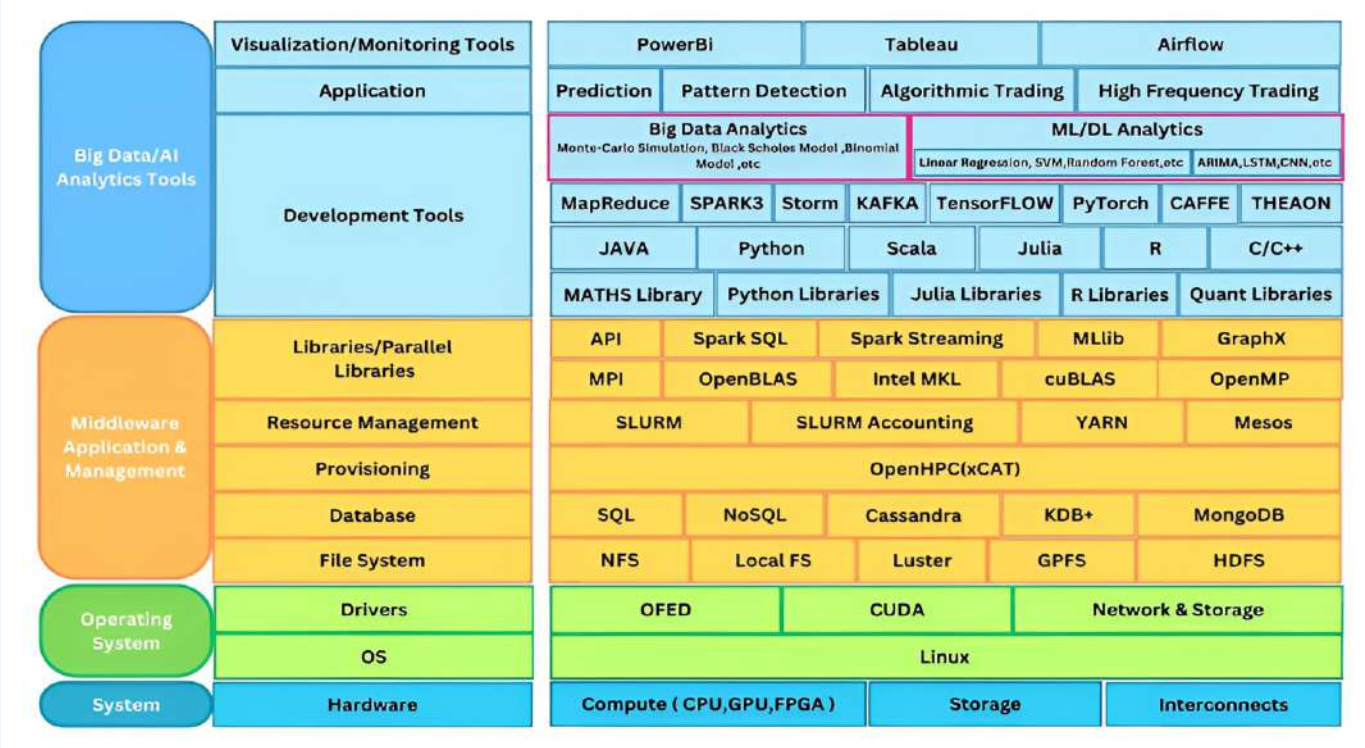


CUDA based SeisAcomod-2D was ported to SYCL base. Intel oneAPI DPC++ to make it runnable on Intel GPU. It enabled single unified source code to run on GPUs of Intel, AMD & Nvidia and on CPU.



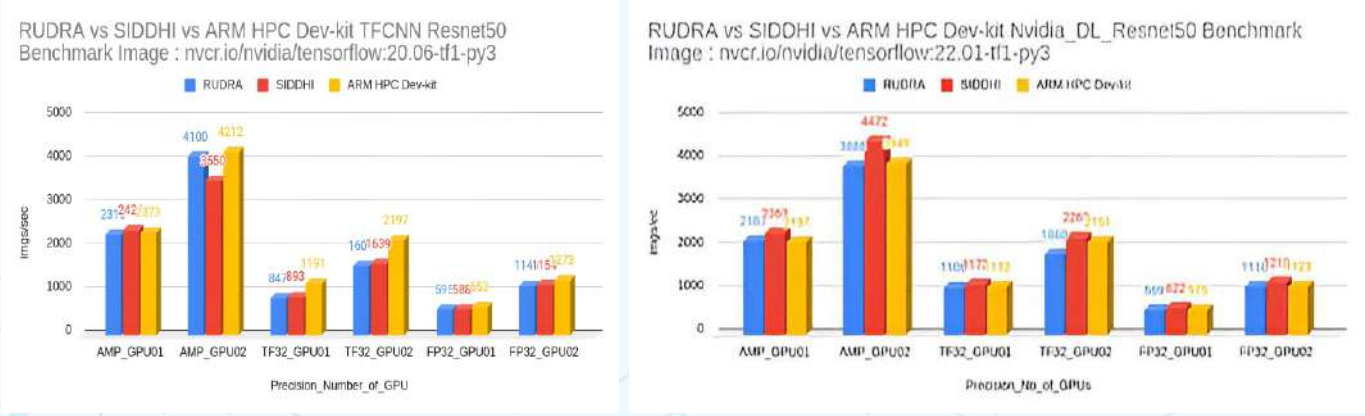
Performance: Intel PVC (GPU Max) vs NVIDIA A100

An indigenous finance modeling software stack is being explored for PARAM clusters using python and Julia packages. Stock market's historical data (40 years) from NSE, India was integrated with live streaming data and tested on a multicore system. Multiple use cases are being implemented for PARAM systems.

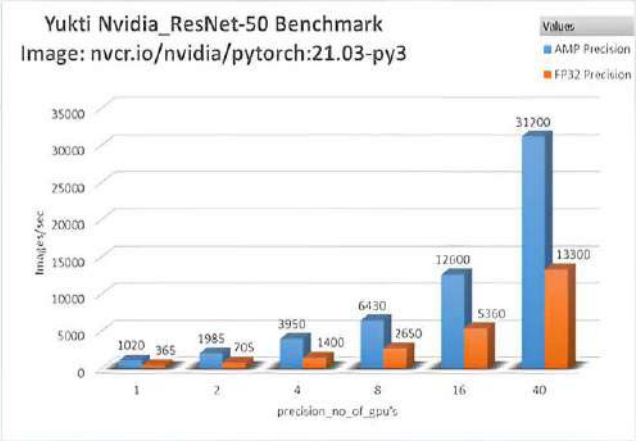


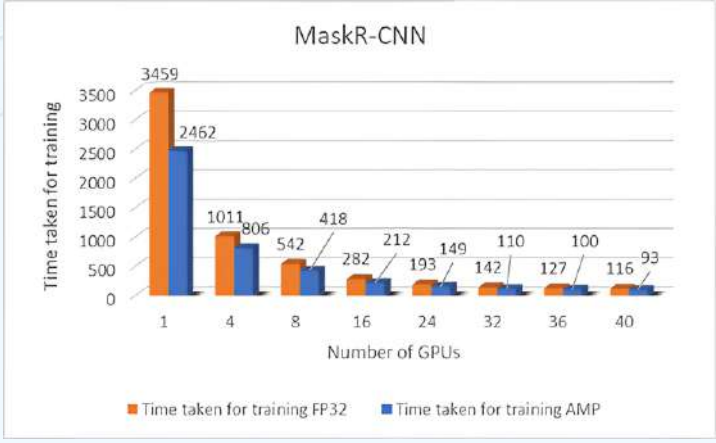
Finance Domain Software Stack

Resnet152 inference benchmarks were explored for comparison on Rudra Server, PARAM Siddhi and Arm Dev Kit to check performance of NVIDIA A100 GPU cards with different hardware architecture.

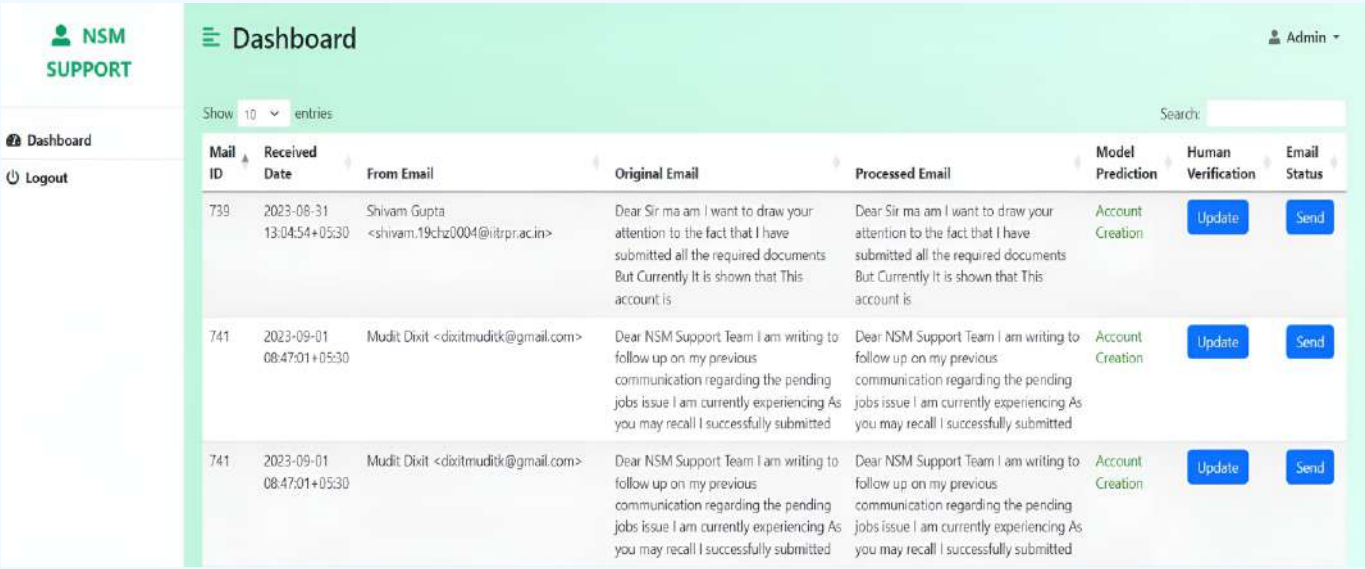


ResNet-50 and MaskRCNN were executed on GPU cluster and scaled up to 40 GPUs to develop and Identify AI/ML Benchmarking Practices for GPU based Clusters (NSM Phase 3).





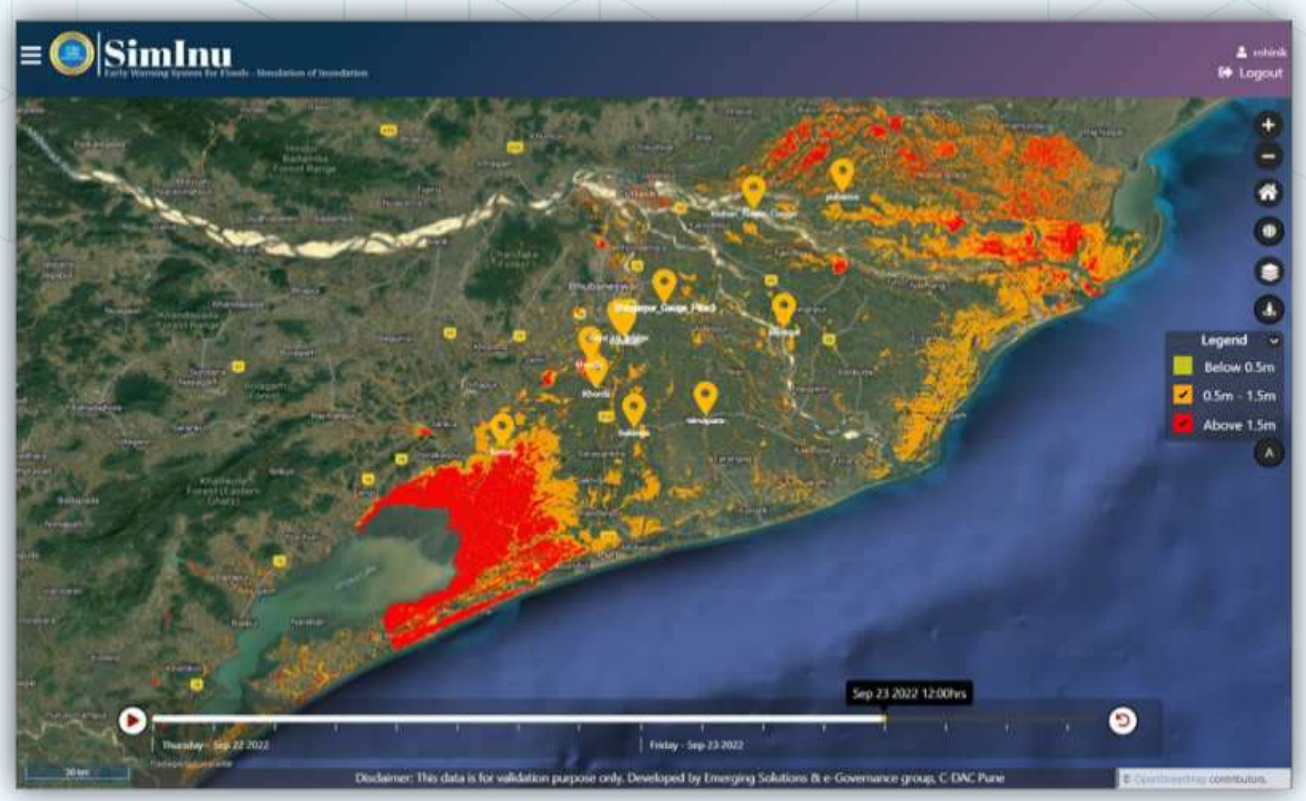
Email Classification : classifies and categorize incoming emails related to NSM Support into two main groups: a) Account generation E-mails and b) Other types of E-mails. BERT Model was employed to train the model. Dataset of 200 emails was utilized. - 100 emails were from the server, other 100 were generated using machine learning techniques.



Context Specific Chatbot : A content-specific chatbot is developed using Generative AI and the RAG (Retrieval-Augmented Generation) technique. It extracts data from websites and converts it into numerical format. A Large Language Model (LLM) was employed to generate natural-sounding responses based on input data.

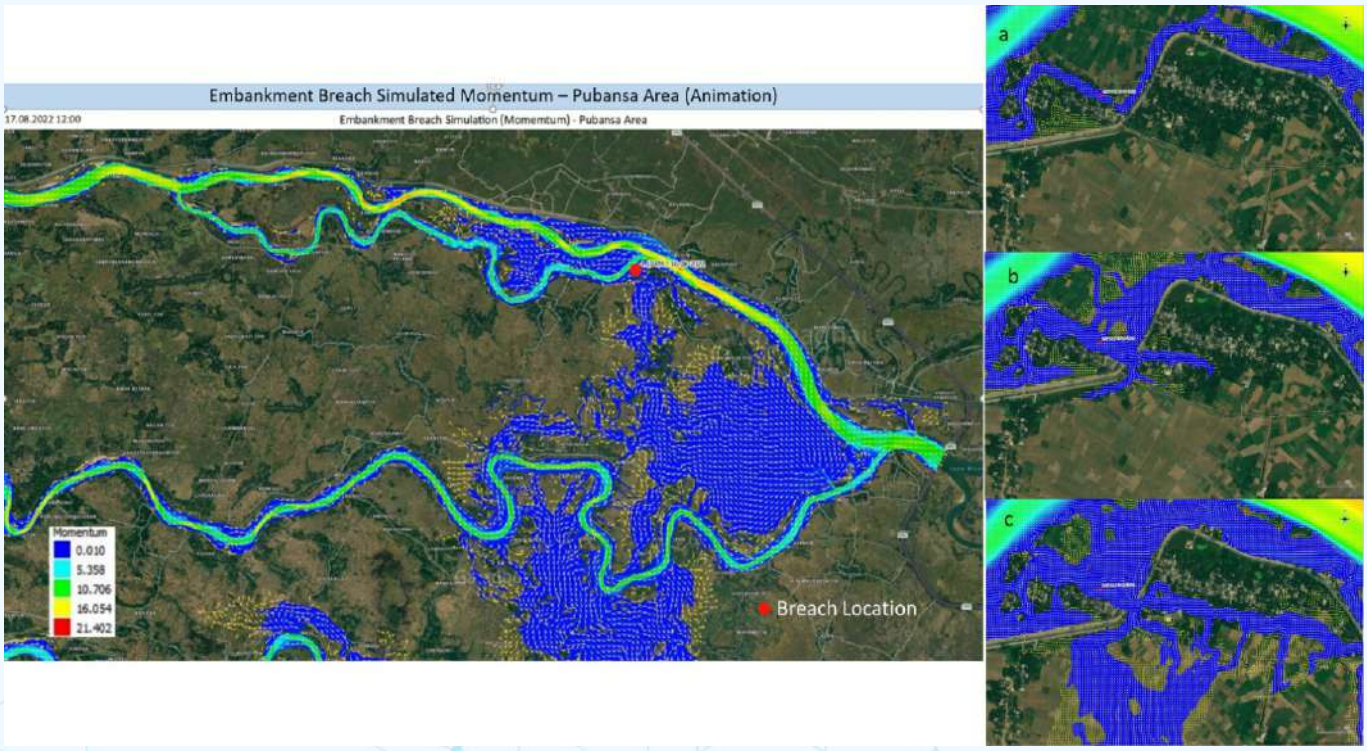
HPC Applications

Early Warning System for Flood Prediction for River Basins of India : SimInu is geospatial portal developed under NSM project on Early Warning System for Flood Prediction for River Basins of India. SimInu was developed to disseminate flood forecasts to disaster managers enabling them to take timely & informed decisions. SimInu revolutionizes data dissemination and visualization by offering real-time insights, including features like a 3-hourly progress bar for the next 2 days, daily inundation spread visualization, and percentage-wise village inundation, significantly aiding mitigation efforts. By overlaying demographic and infrastructure data, it assesses risks comprehensively. The portal aids decision-making, public awareness, and emergency response, enhancing flood management and preparedness significantly.



SimInu- Geospatial Portal

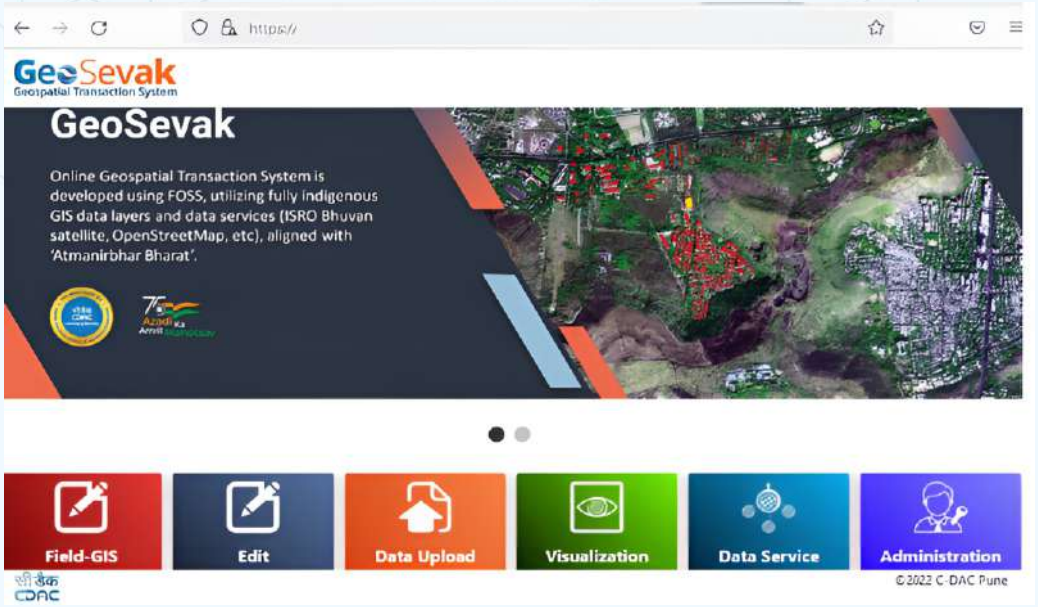
The system caters to special cases like near-real-time embankment breach inundation simulations, providing accurate assessments of damage and water spread. Odisha State Disaster Management Authority (OSDMA) had requested for embankment breach inundation simulations to rapidly assess damage and water spread. OSDMA's inputs, including embankment geometry, water levels, and rainfall forecasts, inform the simulation. The simulation evaluates the damage and predicts water spread, generating visuals like flood maps and animations. These results offer real-time insights into flooding scenarios and guiding effective decision-making.



Embankment breach scenario simulation in Mahanadi River Basin. (Insets a, b and c show the flood progression over time through the breach location)

GeoSevak - Online Geospatial Transaction System

It is a web-GIS framework built upon FOSS utilizing fully indigenous GIS data layers & satellite data services (ISRO Bhuvan, OpenStreetMap, etc.) and aligned with 'Atmanirbhar Bharat'.

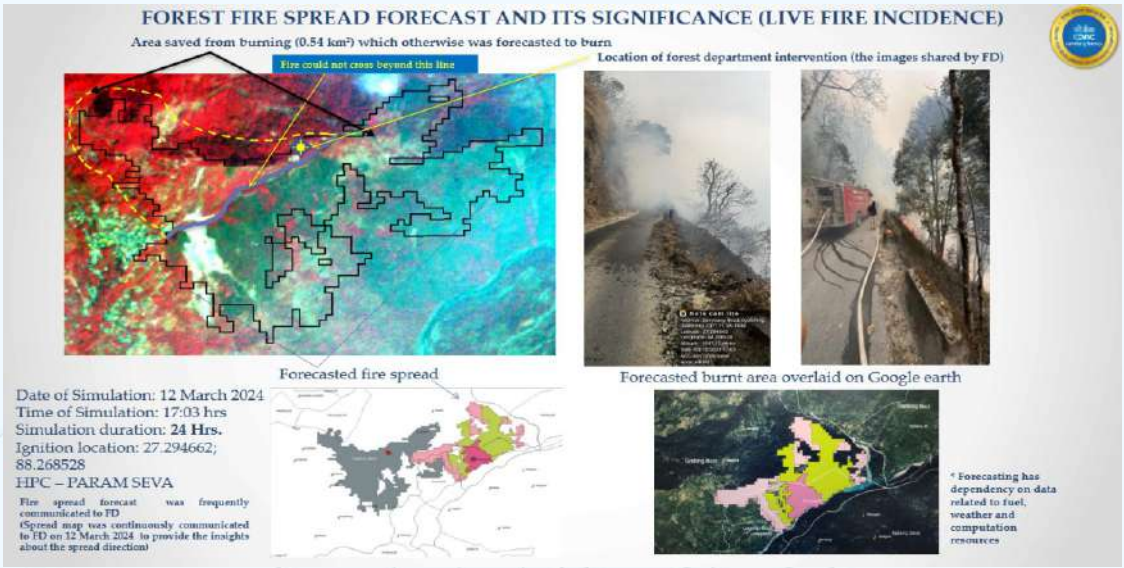


GeoSevak framework

Sikkim Wildfire Forecasting and Monitoring System (SWFMS)

SWFMS is a web-based software application which helps forest department to simulate the wildfire using HPC System. The HPC based simulations happens in the background after data is passed by user through orchestration framework. The forecasted climate data along with fuel, topography and landuse landcover datasets are used for simulation. User can have complete inventory of fire alerts that are received either through satellite or from ground persons. Fire data can be entered, retrieved and analysed in GIS environment.

Forest fire spread model was validated for the live fire spread incidence of Sikkim region on March 12, 2024. The fire spread forecast results were shared with the Forest department Sikkim. In response to this Forest department mobilised its manpower and deployed the fire tender to check the spreading fire. This resulted in controlling the fire from spreading towards North-West Direction, which otherwise was predicted to be burnt. The Forest department Sikkim found the inputs very valuable in emergency forest fire response.



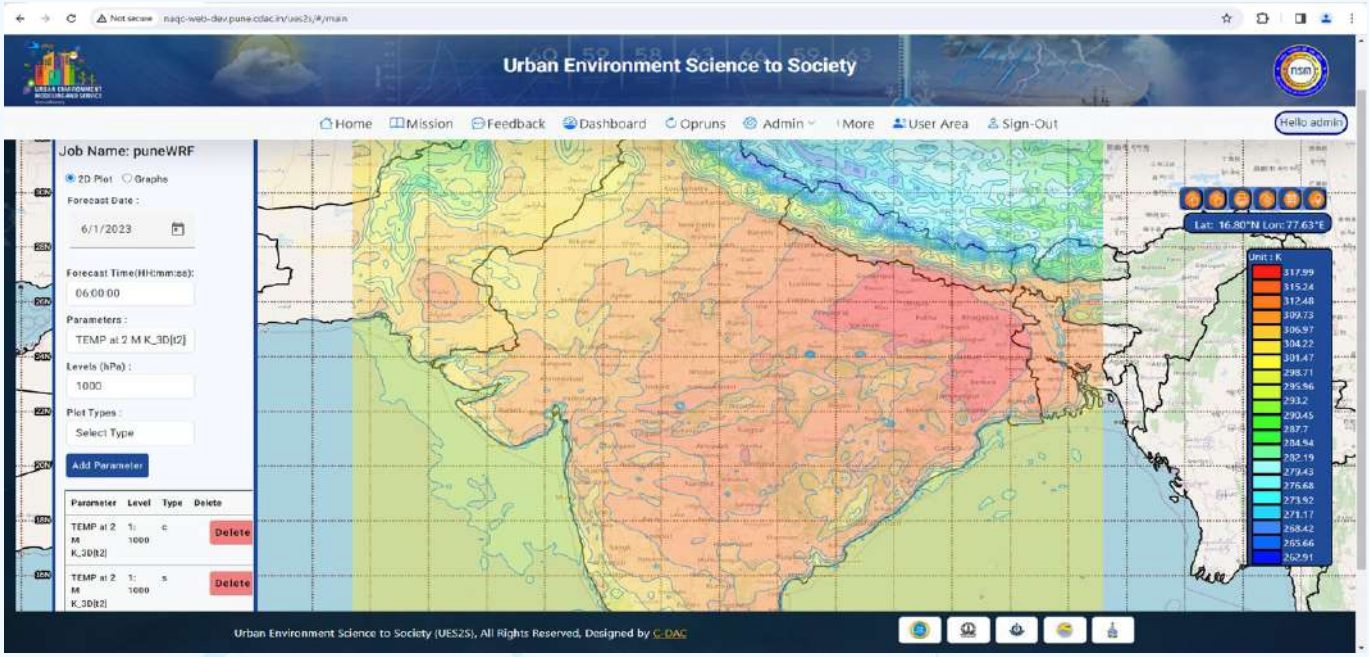
Response by the Forest Department, Sikkim towards controlling the forest fire spread based on the forest Fire Spread Forecast provided by C-DAC

Simulation Lab and Science Based Decision Support Framework

Under NSM Urban modeling project, automated HPC based meteorology, air quality and hydrology model execution workflows were developed. This facilitates end-users with automated model execution of various models on HPC under NSM comprising of automated data download, model execution, model output validation and visualization.

Major development include, A software framework for modelling & simulation, a decision support system, Quasi-operational runs for heavy rainfall and heat wave forecast and Development of integrated reservoir operations model and simulations

HPC based automated Modeling and Decision Support Portal



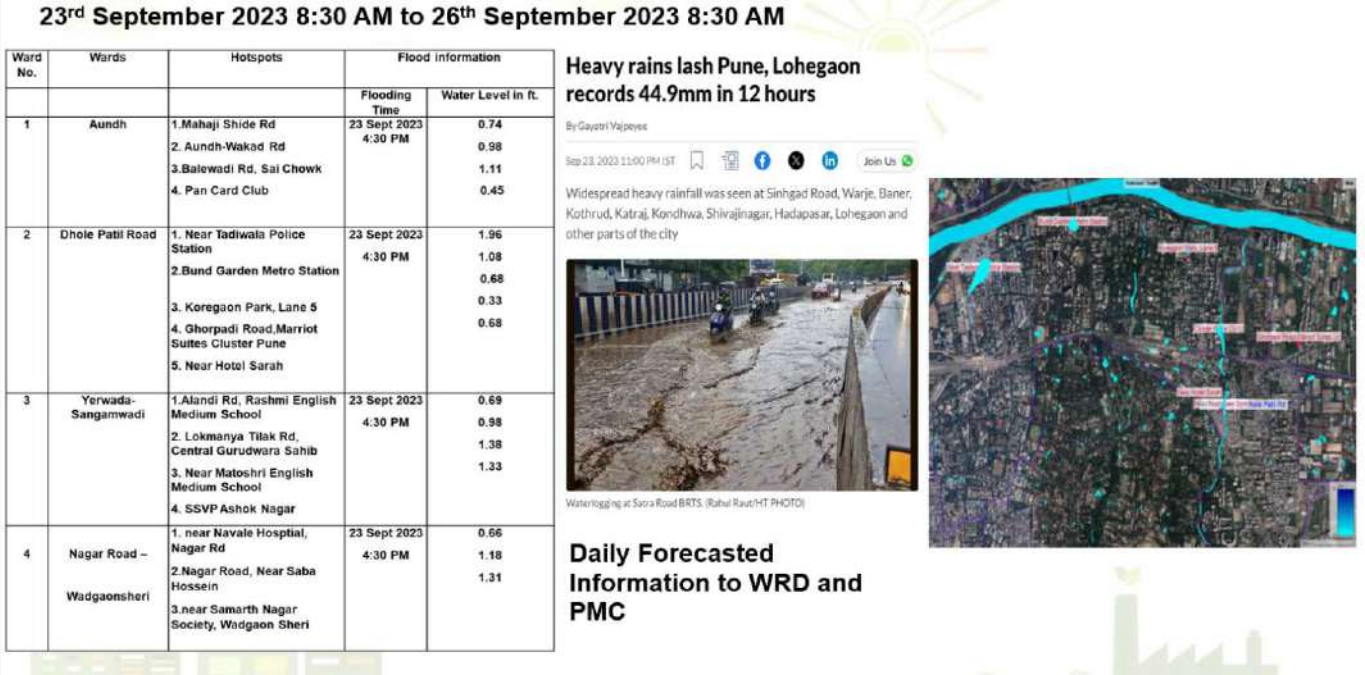
Integrated Model Output Visualization

Quasi-operational runs for heavy rainfall, heat wave forecast and Urban Flood

We have set up a system for the visualization of the daily forecast of meteorological conditions and heat wave events over NSM urban cities. We developed a portal to visualize meteorological parameters such as temperature, pressure, humidity, winds, and rainfall from WRF model simulation output, global forecasted data, and various observational

data. We have automized the entire process of downloading initial condition data from various global models, model pre-processing, simulation, post-processing, and visualization. In addition, high-resolution WRF model data is automatically extracted and converted into the hydrology model required format and shared with the team members for further use. This setup has a facility where users can analyze synoptic atmospheric features and provide their feedback for possible extreme events through the feedback table. High resolution forecasts were given for three NSM cities namely Bhubaneswar, Pune, and Bangalore.

Flooding in the Pune city is triggered by rainfall in the urban catchment areas and the release of water from Khadakwasla, Mulshi and Pawana reservoirs releasing water into Mutha, Mula and Pawana river, respectively. It has become necessary to estimate the quantities of runoff by knowing the amount of rainfall to calculate the required quantities of water storage in reservoirs and to determine the likelihood of flooding. The coupled Hydro-Met modelling Simulation platform was used for Quasi Operational Flood forecasting for Pune and Bangalore Flood Events.



23rd September 2023 8:30 AM to 26th September 2023 8:30 AM

Ward No.	Wards	Hotspots	Flood information	
			Flooding Time	Water Level in ft.
1	Aundh	1.Mahaji Shide Rd	23 Sept 2023 4:30 PM	0.74
		2. Aundh-Wakad Rd		0.98
		3.Balewadi Rd, Sai Chowk		1.11
		4. Pan Card Club		0.45
2	Dhole Patil Road	1. Near Tadiwala Police Station	23 Sept 2023 4:30 PM	1.96
		2.Bund Garden Metro Station		1.08
		3. Koregaon Park, Lane 5		0.68
		4. Ghorpadi Road,Marriot Suites Cluster Pune		0.33
		5. Near Hotel Sarah		0.68
3	Yerwada-Sangamwadi	1.Alandi Rd, Rashmi English Medium School	23 Sept 2023 4:30 PM	0.69
		2. Lokmanya Tilak Rd, Central Gurudwara Sahib		0.98
		3. Near Matoshri English Medium School		1.38
		4. SSVP Ashok Nagar		1.33
4	Nagar Road – Wadgaonsheri	1. near Navale Hosptial, Nagar Rd	23 Sept 2023 4:30 PM	0.66
		2.Nagar Road, Near Saba Hossein		1.18
		3.near Samarth Nagar Society, Wadgaon Sheri		1.31

Heavy rains lash Pune, Lohegaon records 44.9mm in 12 hours

By Gayatri Vajpeyee

Sep 23, 2023 11:00 PM IST

Widespread heavy rainfall was seen at Sinhgad Road, Warje, Baner, Kothrud, Katraj, Kondhwa, Shivajinagar, Hadapasar, Lohegaon and other parts of the city

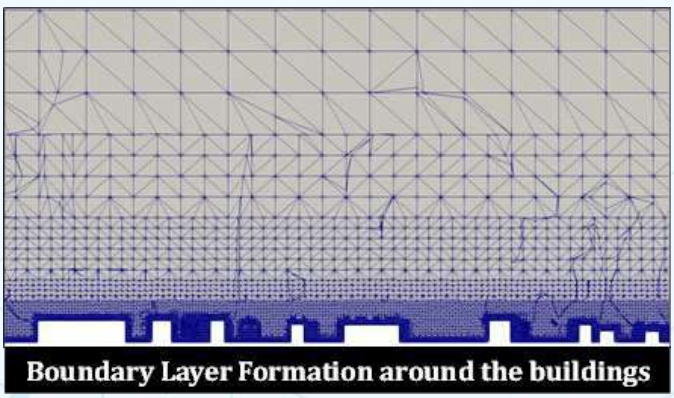
Waterlogging at Sasoa Road BRTS. (Rahul Raut/HT PHOTO)

Daily Forecasted Information to WRD and PMC

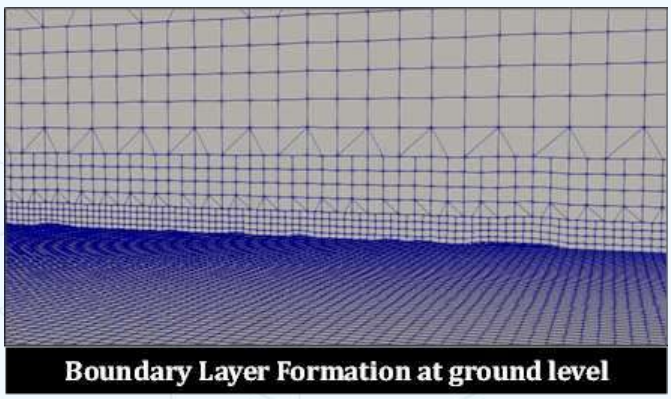
Flood Simulation and Verification

CFD Model for pollution dispersion in a city/ region

The phenomenon of atmospheric flow is characterized by large-scale meteorological disturbances and small-scale wind fluctuations produced by surface terrains and roughness elements. A setup within OpenFOAM was tested and simulated for Pune and Delhi. After successful trails, optimized the simulation time using snappyHexMesh. Boundary layers were generated along ground and around the buildings for optimization.



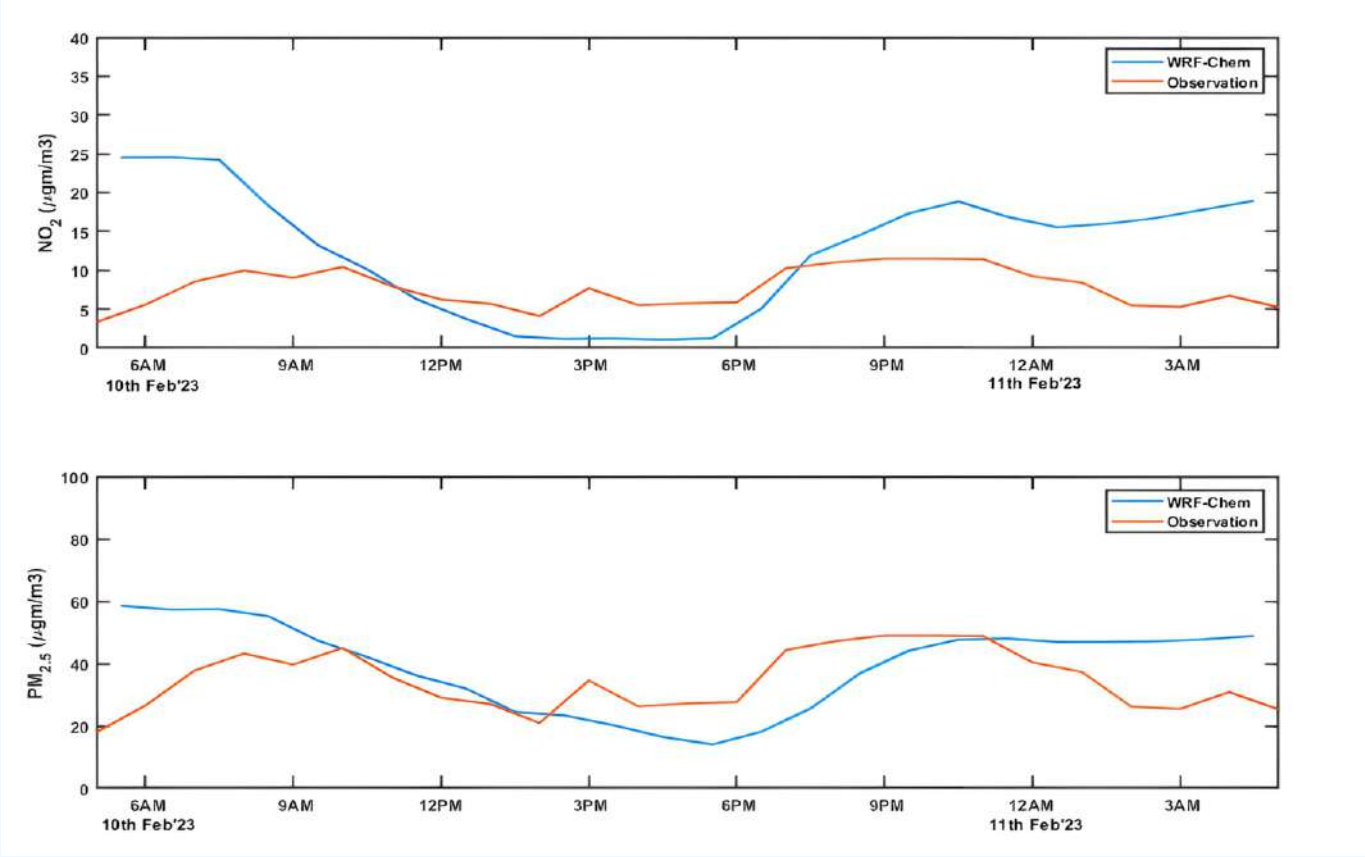
Boundary Layer Formation around the buildings



Boundary Layer Formation at ground level

Parallel Computational Fluid Dynamics Solver for Pollution Dispersion in a city/region

WRF-Chem model was customized using physical parameterization approaches with distinct domains tailored to urban areas (Kanpur, Delhi, and Pune). The results obtained from WRF-Chem simulations indicate that model is capable of representing levels and fluctuations of pollutant concentrations. It is evident that outputs generated by the WRF-Chem model possess the potential to serve as input for SARAS CFD solver, hence enabling prediction of pollutant dispersion at much finer resolutions in real-time meteorological conditions. A comparison of simulated and observed values of NO2 and PM2.5 for Pune city are shown in the figure mentioned below.

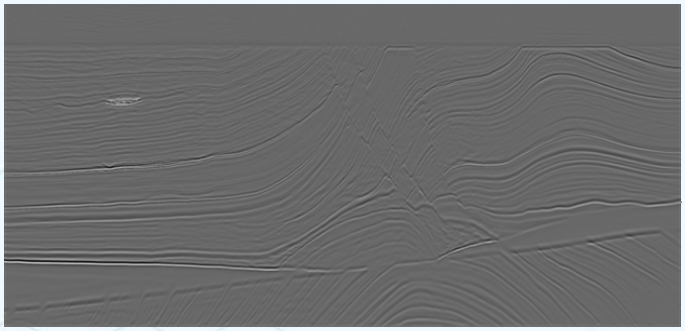


Time series variation of NO2 and PM2.5 obtained from CPCB station observation and WRF-Chem simulations for Pune

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

SeisRTM, with 2D ISO, VTI and 3D ISO capabilities, was deployed at GEOPIC, ONGC and IIT Roorkee. It is being enhanced as per the feedback received from users. 3D Isotropic RTM is being tested using 3D marine streamer data of 20 x 30 x 11 Km for isotropic medium. 2D RTM is being tested using 2D marine streamer data of 67 x 15 Km for Isotropic and anisotropic (VTI &TTI) medium. Developed 2D and 3D pre- and post-processing utilities.

Geological subsurface 2D Marmousi Model

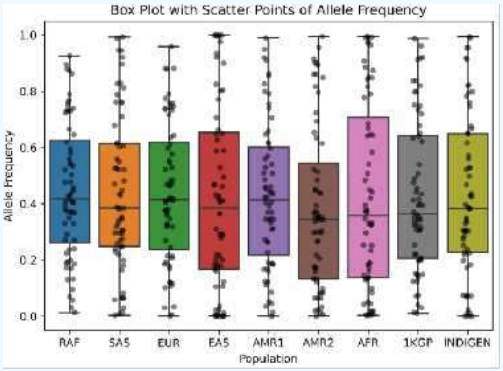


RTM Outcome – Marmousi model

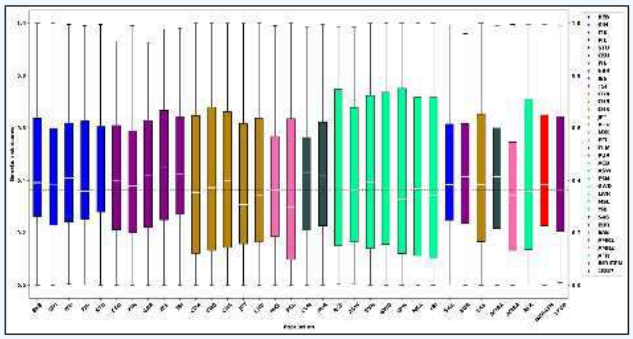
Petascale Genomics studies in 1000 Genome Data

In a study to compare popular variant calling protocols available in terms of their accuracy 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 viz. samtools-bcftools, VarScan2, GATK-HC and DeepVariant. 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. Outcome of above study is - Benchmarking of Bioinformatics tools as well as pipelines for variant prediction using HPC systems (BRAF/PARAM). Work is crucial for clinical genomics and was published as conference proceedings.

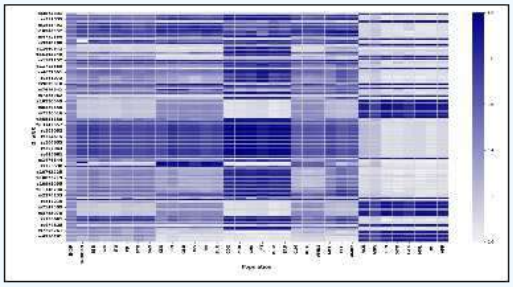
In another study to understand genetic diversity of vitiligo genes in 26 different populations, population specific vitiligo related GWAS SNPs were extracted from 1KGP data keeping in cognizance of the risk allele. Genetic risk scores for the risk alleles were calculated for global 1KGP as well as 7 super-populations along with their 26 sub-populations. Fisher's exact test was performed to study the trends of genetic risk scores in each population with global 1KGP as reference. The comparative analysis of the risk allele scores across different populations were assessed which helped in understanding the prevalence/preponderance of vitiligo in different ethnic groups which would lay the foundation for diagnosis and personalized treatment. Outcome of above study is - Identification of population-specific biomarkers for vitiligo has valuable role in development of diagnostics as well as to analyse disease preponderance in different ethnicities in clinical settings.



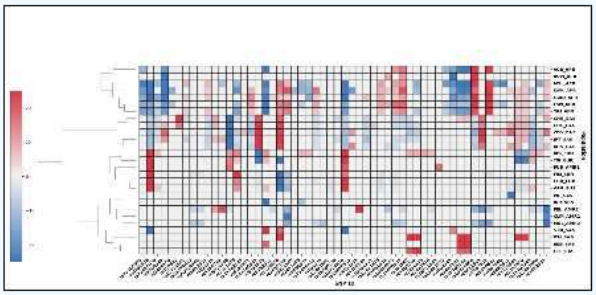
Comparison of the frequency of risk alleles according to super population



Distribution of Genetic Risk score across populations



Distribution of vitiligo associated SNP frequency across populations



Enriched and depleted risk allele of vitiligo associated from GWAS studies across populations

Genetic studies for vitiligo genes across populations

Petascale Genomics studies in Mycobacterium

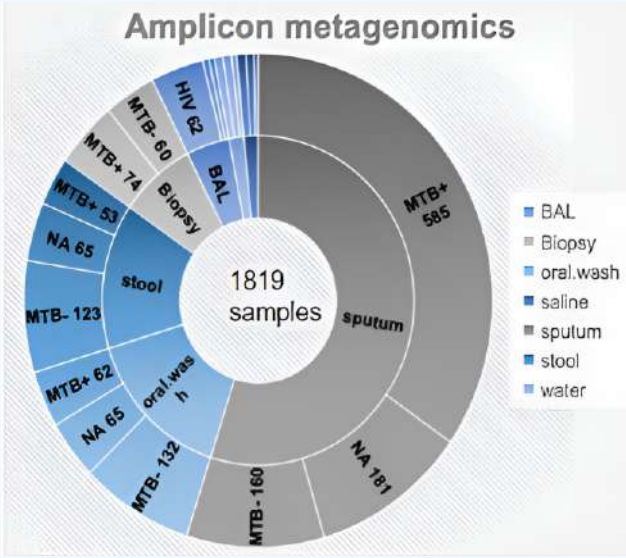
In a study on Lineage identification using ML-based methods for Mycobacterium tuberculosis complex, publicly available MTBC whole-genome sequence (WGS) samples from the human-adapted lineage were used for the identification of SNPs markers using ML-based classification methods. Hyperparameter tuning for supervised classifiers, namely, RF, linear regression (LR), and decision tree (DT) were implemented to attain the highest model performance along with a 10-fold cross-validation technique to ensure the robustness of the trained model. MI

identified 693 potential SNPs which were capable of classifying the lineages of MTBC with 99% accuracy and specificity across all implemented classifiers. This study provides a ML application for the identification of MTBC biomarkers which would aid in timely TB diagnostics, assisting public health surveillance and control.

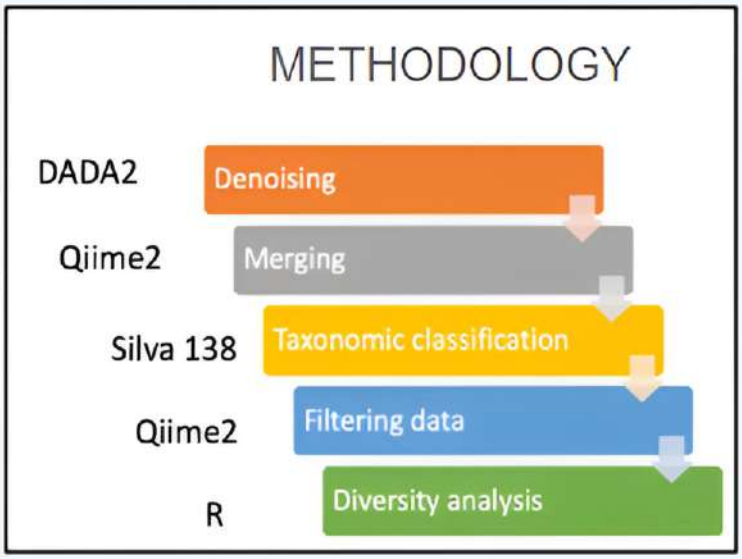
Outcome of above study is - Machine learning based tool that can be used for quick genome-based classification of tuberculosis lineages which can be used in disease diagnostics.

Petascale Genomics studies of Metagenomics studies in lung microbiome

In a study on microbial diversity in tuberculosis positive and negative patients, a meta-analysis of eight amplicon metagenomic studies was performed on TB, comprising 1819 samples from different sources including sputum, bronchoalveolar lavage (BAL), biopsy, and stool. The FASTQ reads were denoised into amplicon sequence variants (ASVs) using DADA2 and were assigned taxonomy against Silva 138 database using Qiime2 feature classifier. Diversity analysis revealed a clear separation of samples by source type than disease-status, suggesting more influence of tissue environment in determining microbial community. Differential abundance analyses were conducted separately for each source type. BAL samples showed a significant abundance of the Mycobacterium genus in MTB positive samples. Outcome of above study is - A meta-analysis to identify microbial abundance in clinical samples for tuberculosis diagnosis. The study provides clues to develop panel for tuberculosis detection.



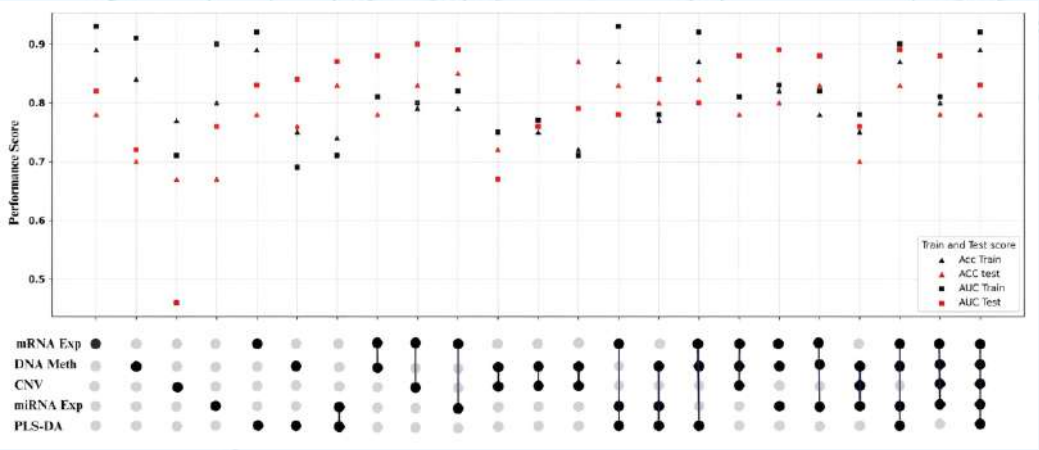
Samples for meta-analysis study of lung microbiome



Methodology for amplicon sequence analysis

Petascale Genomics studies in Breast Cancer

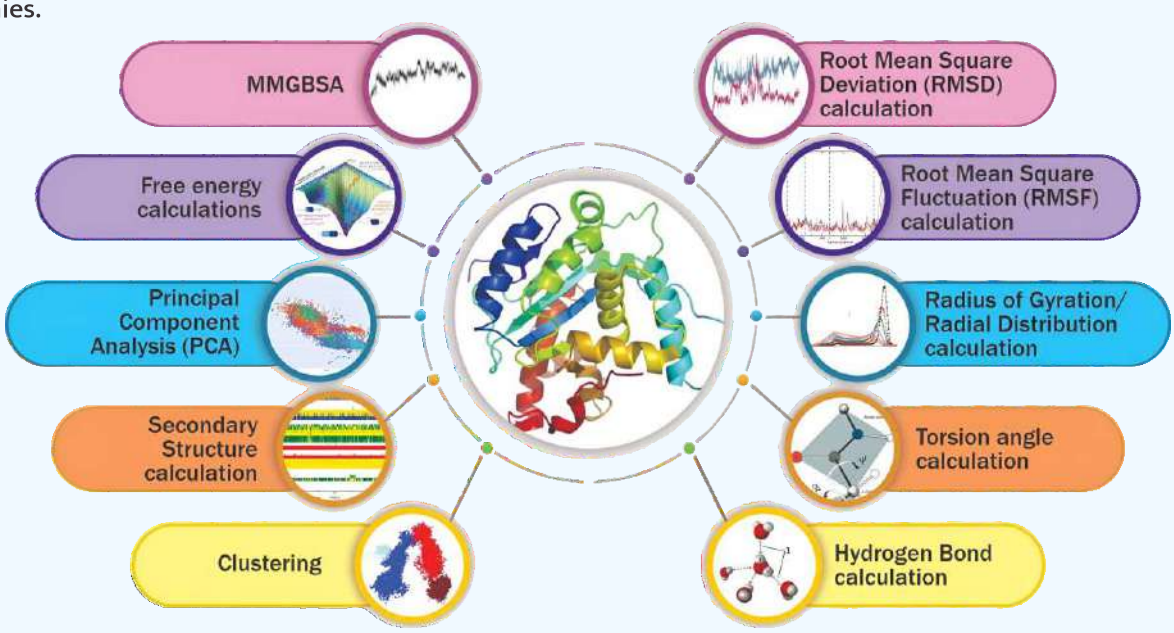
In a study on multi-omics data integration using supervised ML approaches, analysis of results obtained revealed that SVM with PLS-DA method (integrated with gene expression, DNA methylation, and miRNA expression modalities) was the best-performing model with an Area Under Curve (AUC) of 89% and an accuracy of 82% for survival prediction. The study demonstrates the effective use of a multi-ensemble ML model with efficient feature selection methods as a robust protocol for cancer genotype to phenotype correlation. Outcome of above study is - A machine learning based tool for survival prediction using multiple omics datasets from breast cancer patients. The tool is valuable for clinicians in designing therapeutic regimens.



Performance of modalities and data fusion approaches for survival prediction of breast cancer

DPICT: A parallel molecular visualizer & trajectory analysis tools for molecular dynamics simulations

It provides biomolecular visualization and analysis of molecular dynamics trajectories simultaneously. It supports upto nine trajectories at a time. A synchronous mode is available to perform identical rendering and analysis options for multiple trajectories. SSH facility is provided to fetch large trajectories for analysis and visualization. Outcome of above study is - Enhancement of advanced visualization and analysis tool for molecular dynamics trajectories developed for HPC systems (BRAF/PARAM) under NSM. End-users of this tool are academic researchers and pharma companies.



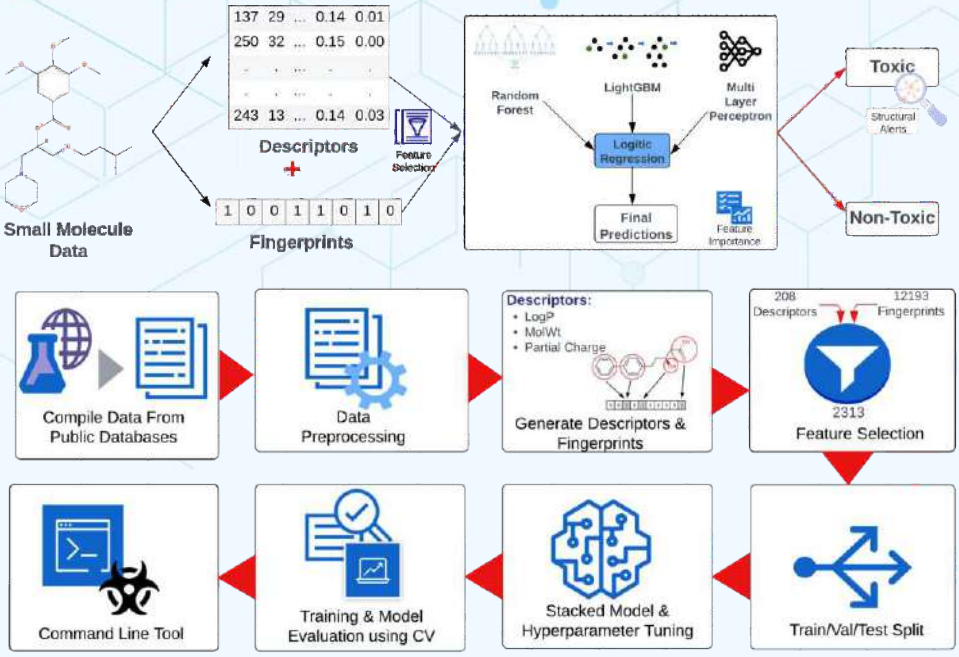
Visualization and analysis of molecular dynamics trajectories

TANGO-DOCK: Automated pipeline for molecular docking of multiple proteins using multiple ligands

Blind docking, site-specific docking and residue specific docking are supported. The output consists of a consensus table which gives an all to all comparison of every protein against every ligand docked. The tool has been tested with larger datasets of protein ligand molecules. Outcome of above study is - A high-throughput tool developed under NSM for molecular docking capable of handling multiple proteins and multiple ligands simultaneously. The tool is very useful for pharmaceutical industry in prioritizing targets for drug-design.

MolToxPred

It is a novel stacked based ML model for prediction of toxicity for small molecules and metabolites. It is designed as a comprehensive feature selection process and optimized model's hyperparameters through Bayesian optimization with stratified 5-fold cross-validation. Outcome of above study is - A machine learning based tool for toxicity prediction of small molecules that is valuable in drug design. This tool is very critical for novel drug discovery.



CIMULATE

A new approach of decomposition was implemented for consistency results on varying numbers of processes. The code is being tested and debugged for issues such as accuracy, segmentation faults after very long runs, cell list implementation for large system sizes. PME code was rewritten to optimize the number of grid points. Outcome of above study is - An indigenous lightweight tool for molecular dynamics simulations to be tuned for HPC systems being developed at C-DAC under NSM.

ICE (Integrated Computing Environment)

ICE is a National Cloud-based Computational facility for Bioinformatics. It aims at development of an application for a Big Data analytics tool that is capable of analysing NGS data and is scalable and portable on any cloud-based distributed computing platform, where you can not only store human data but can be used for agriculture, livestock, and microbes as well. MolToxPred tool integrated and tested with the ICE framework. Outcome of above study is - An integrated storage and compute solution based on Kubernetes for biological data handling. End-users are Indian Biological Data Centre and Indian academic researchers.

International Collaboration

During 13th symposium of ADAC (Accelerated Data Analytics and Computing institute – an institute established to explore potential future collaboration among elite laboratories worldwide) held at Paris, a keynote presentation was delivered showcasing HPC areas in which C-DAC is working and is willing to collaborate/ contribute with international community. Subsequently, C-DAC was invited to become affiliate member of ADAC. C-DAC is now affiliate member of ADAC.

C-DAC members are part of working groups related to HPC areas, namely Application and Benchmarking group, Portability, Sustainability and Integration group, Quantum Computing group, and System Management group, which are formed by ADAC.

C-DAC attended 14th ADAC Symposium and workshop, hosted by the National Computing Infrastructure (NCI) Australia, during February 22-24, 2024 in Sydney, Australia. During this symposium, C-DAC signed MoU with NCI on GPU enablement of the compute intensive part of ANUGA. A paper was presented on “Benchmarks for System Acceptance under the National Supercomputing Mission” explaining the strategies which C-DAC follows to perform the acceptance test for HPC systems.

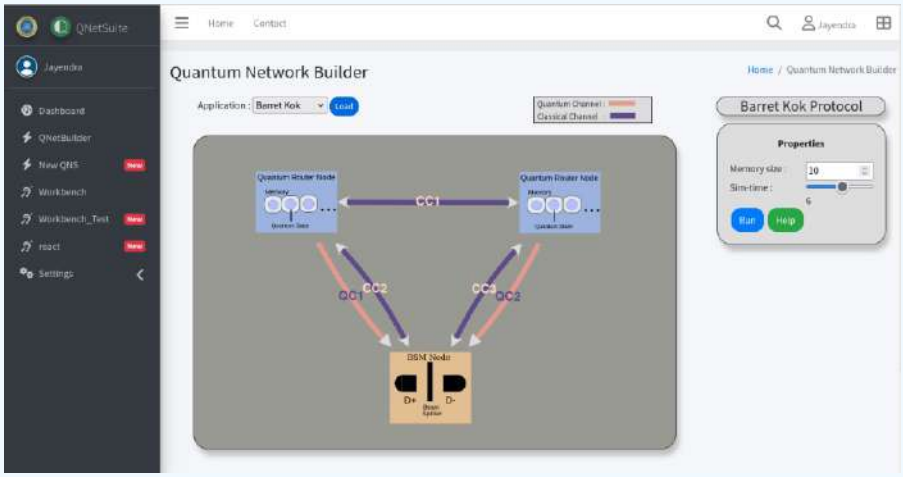
Quantum Computing

C-DAC is advancing numerous projects in the areas of Quantum computing, communication, and sensing including development of the QSim toolkit, Quantum Accelerator, FPGA-based Quantum control hardware, Quantum network simulator. C-DAC is also working on Quantum-safe financial frameworks, Quantum communication via drones, and Quantum sensors for water pollutant detection. Various solutions developed by C-DAC in this area are as below.

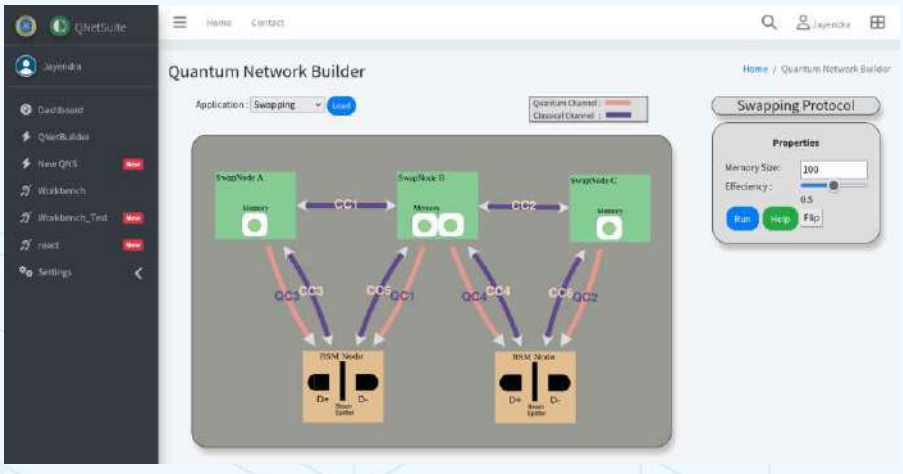
Quantum Network Simulator (QNS)

Quantum Network Simulator efficiently simulate the communication of Quantum information over Quantum networks leading to the ultimate goal of realizing the Quantum Internet. It's a software framework to simulate & model Quantum Networks up to the application layer. It helps to study the performance of multiple Quantum network protocols, topologies & configurations.

This system is designed for creating and testing Quantum communication protocols, including foundational techniques like Quantum Teleportation, Quantum Key Distribution (QKD), and Superdense Coding. Users can easily adjust input parameters for various experiments and download the data for further analysis. The system supports communication through customizable noisy Quantum channels, ensuring proper synchronization across the network. It also models complex Quantum processes such as entanglement generation, swapping, and purification. With integration into C-DAC's high-performance computing resources, the system efficiently simulates these protocols. Additionally, it features a user-friendly interface with extensive libraries and APIs and is available as a cloud service for flexible and modular use. The Quantum Network Simulator (QNS) is a cloud-based service hosted in C-DAC, Bengaluru.



Simulation of Barret Kok Protocol



Simulation of Swapping Protocol

QuIPs: Quantum Computing Control IPs

The control hardware for Quantum computing includes RF-DACs and RF-ADCs with 14-bit resolution and 12-bit resolution, 8 GB DDR4 memory, and a range of peripherals for seamless integration with existing frameworks and software. It offers flexibility, scalability, multi-processing, real-time control, low latency, high bandwidth, and easy framework transition. Its key features include Arbitrary Waveform Generation (AWG), LUT-based and custom sample signal generation, and a data acquisition system. Python-based applications can run on the embedded hardcore processor and communicate with the FPGA programmable logic design. The hardware is compatible with Ubuntu and Ethernet, providing a familiar operating system environment for Quantum computing development. The hardware finds applications in Quantum gate implementation, state preparation, measurement, algorithm development, time domain measurements, and error correction.

This system offers several key features for Quantum computing development. The AWG feature enables to create precise and complex waveforms customized to specific needs. Users can generate control waveforms using predefined or user-defined samples, which are played through RF-DACs in both baseband and microwave ranges. The system has a Data Acquisition System for capturing and storing readout data via RF-ADC for detailed analysis.

Control hardware

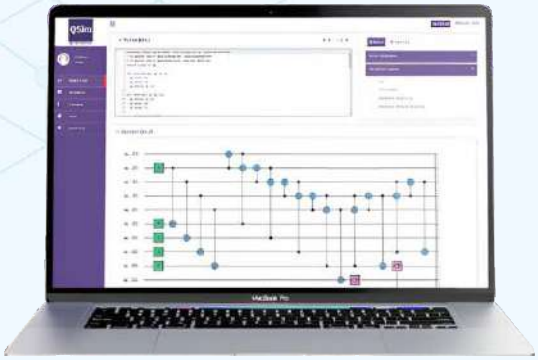
QSim: Design and Development of Quantum Computing Toolkit Simulator, Workbench and Capacity Building

The Quantum Computing Toolkit Project is one of the first initiatives in the country with an objective to enable a toolkit for advancing in Quantum Computing research in India. The project is conceptualized by a multi-institutional approach with IISc Bengaluru, IIT-Roorkee, C-DAC Bangalore and C-DAC Hyderabad. QSim allows researchers to explore Quantum algorithms under idealized conditions and help prepare experiments to run on actual Quantum hardware.

This system provides a dynamic simulation environment for Quantum circuits using an advanced Python editor and instant circuit generator. Users can fine-tune various Quantum noise parameters such as rotation errors, thermal factors, depolarization, and de-coherence. It supports multiple types of Quantum measurements, including ensemble, Bell, single qubit, and expectation measurements. Users can initialize qubits in different states like binary strings, maximally mixed, uniform superposition, or thermal states. The system offers visualization tools, including graphs and histograms, and comes pre-loaded with Quantum algorithms like Grover's, Bernstein Vazirani, ripple adder, QFT, and DJ algorithms. Additionally, it integrates with HPC resources like PARAM Shakti and PARAM Utkarsh, enabling multiple users to run circuit simulations simultaneously.

More than six thousand users from esteemed institutes and research organizations, including DRDO, CAIR DRDO, RCI, RRI, SETS India, IISER, IGCAR, BEL, TCS, IBM, Infosys, Salesforce, Sarvaa Research, Innovation Pvt. Ltd, IITs, BITS Pilani, Calcutta University, ISTM, Amrita, VIT, and more. The team has focused on bug fixes and security maintenance while conducting over 1,200 Quantum simulations. The user base has grown to 6,374, with nearly 600 new users joining in the last year alone.

Qsim: Quantum Computer Simulator



Qsim Workbench

Centre for Excellence in Quantum Technology (CoE in QT)

The project aims to develop Quantum technology in India, starting with the construction and optimization of its elementary building blocks. The dominant fields of research in Quantum technology are Quantum Computation and Quantum Communications. The project was a collaborative effort by C-DAC, IISc and RRI.

It focuses on developing Quantum computation hardware, including a 4-qubit Quantum processor and the necessary infrastructure for nanofabrication, control, and measurement electronics. It also targets the development of Quantum communication hardware such as single photon sources, detectors, Quantum random number generators, and integrated photonic Quantum networks for short-range lab experiments. The project will study Quantum interactions in solid-state systems, waveguides, and ion/atom traps to advance Quantum sensing technology. Theoretical support will include work on Quantum algorithms, simulators with noisy gates, QKD protocols, and post-Quantum cryptography. At C-DAC, efforts will be directed towards creating FPGA-based Quantum measurement hardware that interfaces with 4-qubit processors and developing a Python-based software interface for this hardware.

This project delivered several key advancements in Quantum technology. These include a 4-qubit Quantum processor using superconducting transmon architecture and graphene-based single photon detectors for 400-800 nm, along with highly sensitive photodetectors for 800-1700 nm. The project demonstrated fiber-based and free-space QKD over a few kilometers, design and optimize low-loss optical fibers for Quantum communication, and create Quantum algorithms and simulators for noisy devices. FPGA-based Quantum control and measurement hardware, along with a complete Python-based software framework for Quantum measurement is developed.

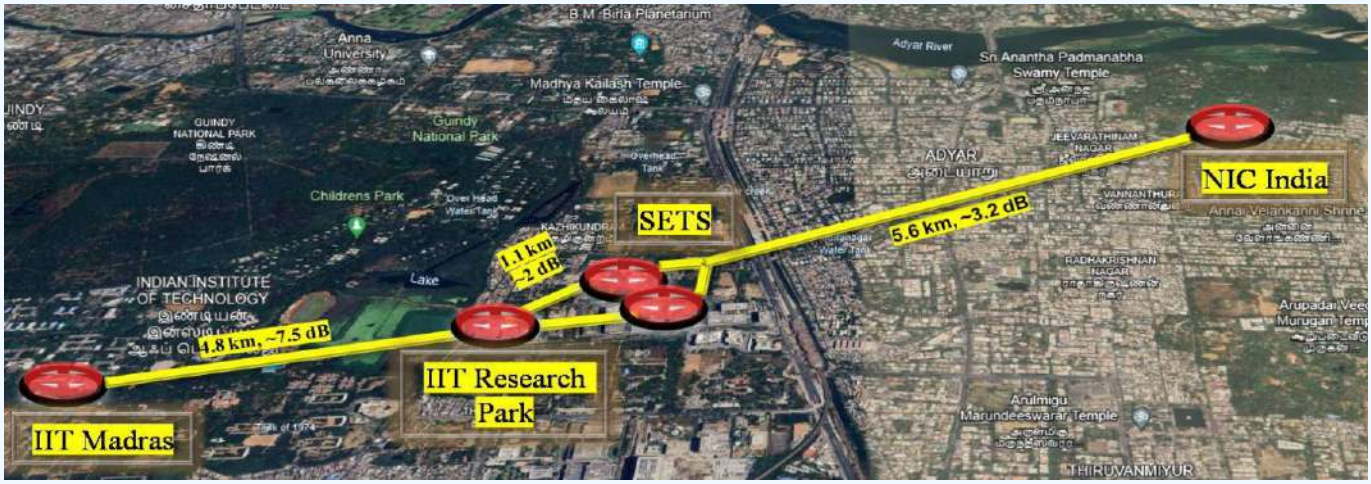
FPGA based control and measurement hardware for 4-qubit superconducting based quantum computer

Metro Area Quantum Access Network (MAQAN)

A team at IITM, SETS, ERNET and C-DAC has implemented India's first QKD network as a 5-node Metro Area Quantum Access Network (MAQAN) at Chennai. The network is spread over a distance of ~11.5 km and provides a testbed to experiment on different QKD protocols. Such a network will layout the requirements for city based QKD networks of the future.

The consortia has developed indigenous QKD hardware, firmware, and software for India's first QKD network using well-known Quantum Key Distribution (QKD) protocols like CoW, DPS etc. The network is managed through a Software defined Network layer. C-DAC has developed electronics for QKD control and implementation. It has a FPGA based design augmented with an indigenous FMC card. The FMC control card provides interfaces to generate TRNG sourced patterns for intensity and phase modulators, provide gate signals for single photon detectors, manage data acquisition from these detectors through a time-to-digital converter, generates bias for optical components etc.

MAQAN is a Ministry of Electronics and Information Technology (MeitY), funded initiative to support QKD research in India. QKD provides a key exchange mechanism that is based on the law of Quantum mechanics rather than mathematical complexities and this ensures security not only for today but also against any omnipotent future adversary.



Metro Area Quantum Access Network (MAQAN) deployment

HPC based Quantum Accelerators for enabling Quantum Computing on Supercomputers

The Quantum Accelerator project, is an effort to develop a Quantum computing simulator platform, using high-performance computing capabilities of existing PARAM supercomputers. Its primary objective is to expedite the execution of Quantum algorithms, harnessing the processing power of GPU, Vector, and FPGA accelerator cards. The major outcome of this project is the establishment of a "Quantum Experience Centre", which will serve as a national hub for Quantum software development in a cloud-based environment. A demonstration featuring the state-of-the-art Rudra GPU board was completed.

Quantum Accelerator testbeds (GPU/Vector/FPGA)

FinTeQ-Quantum-Safe Financial Transaction Framework

The project is actively working on addressing financial network security by developing a Quantum-Safe Financial Transaction Framework. This framework aims to secure financial transactions even against Quantum-enabled adversaries.

The project employs a two-step approach to address this issue.

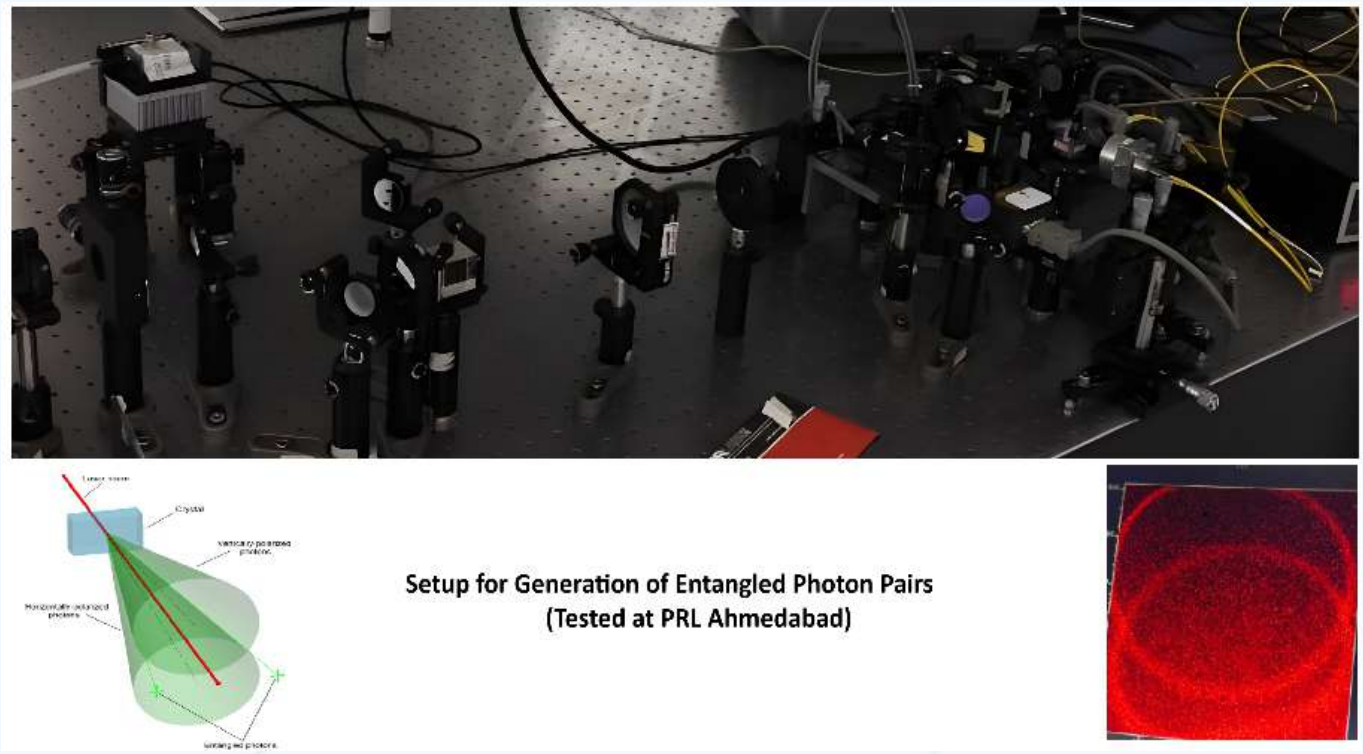
B2B Financial Transactions: Institutions will utilize fiber-based Quantum Key Distribution (QKD) to securely exchange symmetric keys. These keys will then be used to secure transactions with symmetric-key cryptography, such as AES-256. In the Quantum realm, AES-256 provides 128-bit security due to Grover's algorithm.

B2C and C2C Financial Transactions: Transactions between consumers or between consumers and financial institutions will be secured using indigenously developed secure USB dongles. These dongles use a Secure Application Framework based on web and mobile platforms, providing an additional layer of security. They electronically verify identity, act as electronic keys, and enable two-factor authentication for applications where security is critical.

MUDI (Mobile Phone and USB Dongle Interface) was developed for the integration of TrusToken with SAMAF (Secure Access to Mobile Application Framework). SAWAF (Secure Access to Web Application Framework) was developed and integrated with a PKCS #11 interface for seamless interoperability with existing token hardware in the market. SAMAF is currently being developed and interfaced with PKCS#11.

Quantum optical sensor-based system

Quantum optical sensor based system has been tested by C-DAC at the Physical Research Laboratory, Ahmedabad. The possibility of obtaining the coincidence counts for the Hong-Ou-Mandel dip was affirmatively checked using the setup.



Experimental setup for producing the entangled photons

Quantum labs at C-DAC

The Quantum Labs at C-DAC are cutting-edge facilities dedicated to advancing Quantum technologies. They focus on pioneering research and development in Quantum computing and communication. These cutting-edge facilities are instrumental in pushing the boundaries of Quantum research and technology, driving breakthroughs that enhance Quantum capabilities.

QuBIT Studio at C-DAC Bangalore

QuBIT Studio is a specialized laboratory committed to pushing forward the frontier of Quantum accelerated computing. This initiative receives funding from MeitY through the program "HPC based Quantum Accelerators for enabling Quantum Computing on Supercomputers." The principal goal of QuBIT Studio is to create hybrid computing systems that seamlessly merge various Quantum technologies, including photonic computation, with conventional High-Performance Computing (HPC) architectures. This strategy seeks to capitalize on the advantages of both technologies to fully exploit the potential of Quantum computing and expedite its real-world applications.

On January 23, 2024, QuBIT Studio was formally inaugurated by Shri S. Krishnan, IAS, Secretary, Ministry of Electronics and Information Technology (MeitY), in presence of Smt. Sunita Verma, Scientist G & Group Coordinator, MeitY, and Dr. C. M. Chandrasekhar from IISc, Bangalore.

Quantum Technology Lab at C-DAC Pune

It is the first of its kind lab at C-DAC Pune which was inaugurated by Shri S. Krishnan, IAS, Secretary, Ministry of Electronics and Information Technology (MeitY) on November 25, 2023. It features a clean room for experimenting with Quantum Technology devices in the areas of communication and control electronics. This lab features a dedicated clean room facility to facilitate research in Quantum technology, focusing on Quantum Communication and control electronics for Quantum Devices. It will accommodate advanced equipment for testing and characterizing Quantum communication and devices.

International engagements in Quantum Computing

The visit of delegation to Espoo, Finland and Delft, Netherlands, served as a crucial component of the delegation's efforts to expand and enhance India's Quantum Technology initiatives. The engagements, discussions, and facility visits facilitated valuable collaborations and knowledge sharing between India, Finnish and Dutch stakeholders. The insights gained from this visit will contribute significantly to the advancement of the Quantum Technology sector in India and strengthen international cooperation in this domain. The visit proved to be an exceptionally educational and enlightening experience, providing valuable insights into the advancements and latest developments in Quantum Technology. Given the crucial role that C-DAC plays in Quantum Computing in India, it was imperative to gain exposure to international progress and advancements in this domain. This visit was of utmost significance as it facilitated a comprehensive understanding of global developments, enabling India to effectively develop its Quantum ecosystem in alignment with international standards.

Artificial Intelligence (AI)

C-DAC is at the forefront of research and development in Artificial Intelligence (AI), which focuses on various AI technologies, including Natural Language Processing, Machine Learning, and Computer Vision. C-DAC's AI initiatives are geared towards solving complex problems in domains such as healthcare, agriculture, and cyber security. Various solutions developed by C-DAC in this area are as below.

Authorship Attribution Methods for Forensics Applications

Signature and handwriting matching are two techniques commonly used in forensic investigations to determine the authenticity of documents and identify potential forgeries. The project is aimed to establish similarity between questioned and admitted signature and handwriting samples using AI techniques. The project has been awarded under Extra Mural Grant by Directorate of Forensic Science Services for the duration November 22, 2022 to November 21, 2024.

The following modules have been developed

1. Automatic signature detection: The module is capable of identifying the signature images present in the given document image. The system is trained with varying layouts having handwritten text, machine printed data, photographs and signatures.
2. Advanced AI based Signature matching: Siamese Network, Triplet loss-based models and VIT based models has been experimented with for the generating the matching score between two given samples. The models have been trained on various datasets along with custom dataset

Web based Application: The web-based solution is being developed in consultation with CFSL Shimla. The solution has been deployed at CFSL Shimla and DFSS Delhi for the end-user testing purpose. The document management, dashboard, expert analysis, signature identification, signature matching, score generation module, handwritten words extraction modules have been integrated to the software solution.

OCRs and Applications in Indian Languages

The project aims to develop Indian language OCR system for printed document images at word/line level for Odia, Bangla, Assamese and Manipuri scripts. The project has been awarded by Ministry of Electronics and Information Technology (MeitY) for the duration April 01, 2022 to April 01, 2025. The work involved Indic language data exploration, collection and annotation. The training data has been curated from 58 books, having varieties of orthography, belonging to 4 languages. The total word count is over 70 Lakh word images. Data collection for the Manipuri language is going on.

Deep Neural based models have been developed for Bangla, Odia and Manipuri scripts. Page level Bangla and Odia Model APIs are implemented. End to End services of Hindi OCR has been employed to generate searchable PDFs for the Lok Sabha Debates for over 10 lakh pages.

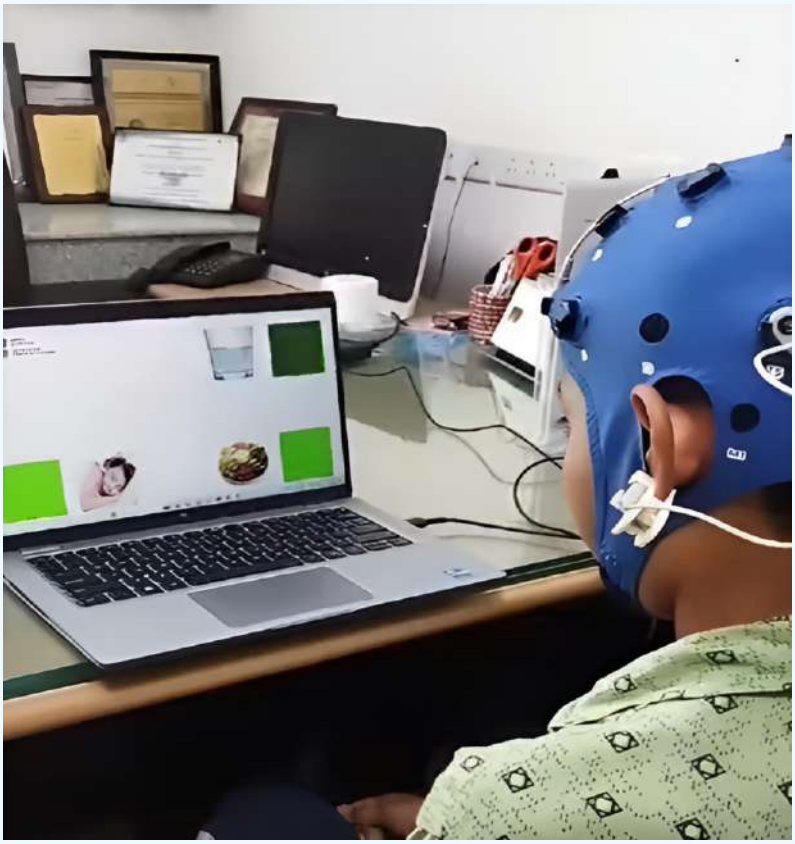
Indian Language to Indian Language Machine Translation System (IL-IL MT)

IL-IL MT system is one of the Machine Translation systems being developed under National Language Translation Mission (NLTM)-Bhashini mission. The project has been awarded by Ministry of Electronics and Information Technology (MeitY) for the duration April 01, 2022 to April 01, 2025. It aims to serve bidirectional, reliable IL-IL machine translation systems for 9 Indian language pairs (Hindi to Punjabi, Telugu, Urdu, Gujarati, Kannada, Odia, Kashmiri, Sindhi, Dogri and Vice Versa).

The consortium, which includes R&D and Academic institutes of international repute, have curated domain specific parallel corpus to build state of the art MT systems by fine-tuning the popular pre-trained MT models. Annotated corpus and NLP tools like shallow parsers for POS, Morph and Chunk tagging have been developed for Punjabi, Odia and Dogri languages. The IL-ILMT system is well capable of translating general, as well as, domain specific text pertaining to Governance, Science & Technology and Health domains.

A Brain Machine Interface enabled Assistive Communication System for Persons with Special Needs

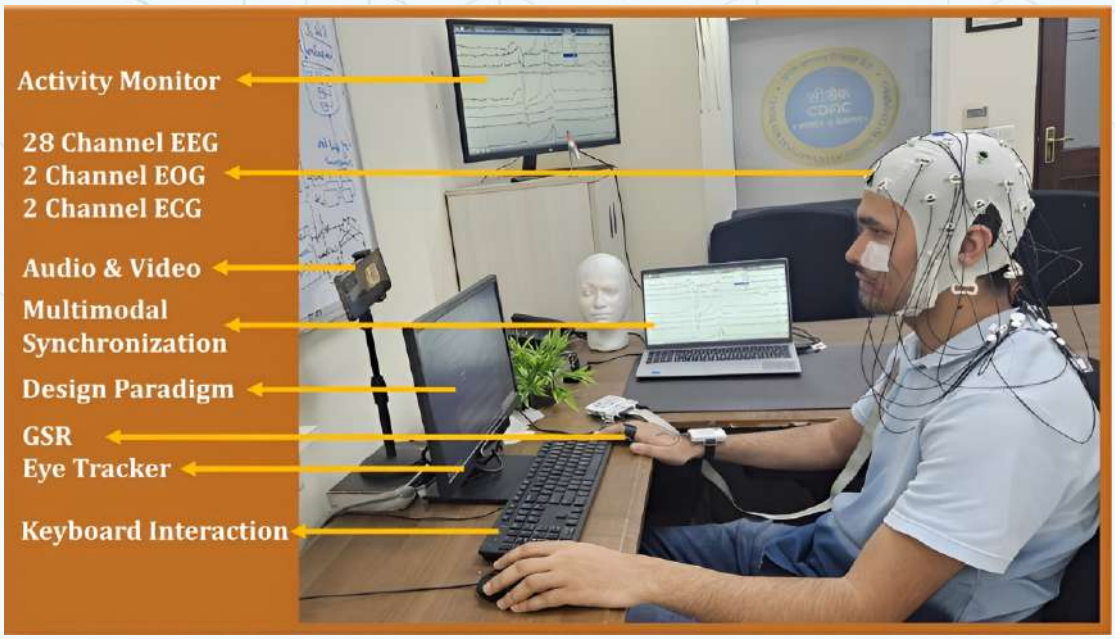
C-DAC has executed the project "BCI enabled Assistive communication system for persons with special needs". The project has been awarded by Ministry of Electronics and Information Technology (MeitY) for the duration January 27, 2022 to January 26, 2025. The system is designed as a multidisciplinary neuro-cognitive computing framework in the collaboration of Clinical experts from AIIMS, Delhi and GMC, Thiruvananthapuram. As of now, Indigenous Indianized Neurological data is generated for 100 persons with special needs. Multiple Neuro-computing approaches like mental imagery, SSVEP and P300 odd-ball paradigms are developed for training and testing purpose. The BCI Spellers paradigms are implemented as Standalone and Web-based Interfaces. Field testing is in progress at client side.



BCI Testing in AIIMS Delhi by Children with special need

A Multi-Modal Neuro-Physiological Framework for Behaviour Analysis

C-DAC has successfully completed the project “A Multi-Modal Neuro-Physiological Framework for Behaviour Analysis”. The project was awarded by Ministry of Electronics and Information Technology (MeitY) for the duration March 29, 2022 to March 28, 2024. With the aim to employ it for insider threat detection, it has contributed with psychological specialized design paradigms for creation of comprehensive primary dataset. Multimodal Dataset generation carried out for Human bio-signals like EEG, ECG, EOG, GSR, Eye-tracking, Audio and Video for 100 Indian population. Multimodal AI fusion methods are implemented for stress, anomaly and suspicious behaviour detection. A dash-board is prepared as a data analytics, event-reporting and monitoring tool on web and mobile.



A Multi-Modal Neuro-Physiological Framework

iMedDesk - AI Assisted Healthcare Services Framework

iMedDesk - AI Assisted Healthcare Services Framework aims to develop a mechanism for helping patients seeking information regarding medical or healthcare services at hospitals and aiding doctors to enable them to cater a greater volume of patients in healthcare. The project has been awarded by Ministry of Electronics and Information Technology (MeitY) for the duration January 10, 2023 to January 01, 2025. To cater to voice-based medical enquiries, automatic speech recognition system is enriched with medical terms for adaptation in the medical domain. This adaptation involves fine-tuning the system on domain-specific data to improve recognition accuracy for specialized medical terminology. For text-to-speech synthesis, a pre-processor has been developed to handle medical domain words. This ensures that the synthesized speech accurately pronounces complex clinical terminology. Additionally, intent and entity extraction capabilities have been developed for handling natural language queries from both patients and doctors. A web-based GUI has also been developed to demonstrate the NLU chatbot, providing a user-friendly interface for interacting with the system. Proof of Concept (PoC) with AIIMS Gorakhpur is in progress.

Artificial intelligence in Oncology (iOncology.ai)

This Project which has been jointly conceived by C-DAC and AIIMS New Delhi for harnessing big data and advanced computing to provide personalized diagnosis and treatment for Cancer patients (iOncology.ai). The project has been awarded by Ministry of Electronics and Information Technology (MeitY) for the duration November 20, 2019 to November 19, 2023. It helps establish a methodology for early detection of the India-centric cancer by interrogating the medical and non-medical data sets using AI technology. Major Outcomes under this project are - Web-based platform for screening of cancer patients and AI based data analytics models powered by HPC for cancer risk prediction and prognosis, as well as classification/ segmentation/ characterization of cancer (Breast Cancer, Ovarian Cancer) for modalities like MRI Images/ Histopathology Images/ Mammographic Images/ USG Images; iOncology.ai has been deployed at AIIMS, Delhi in August 2023; Validated Models for Breast cancer from iOncology.ai were presented in "Asian Young Researchers in the 65th JSGO", Japan by AIIMS New Delhi; Showcased at the Med-Hackathon event during Research Day celebrations at AIIMS on January 30, 2024; Copyright filed with dairy no: 6131/2024-CO/SW; Further deployment in following 6 district hospitals in January 2024, and may be scaled up further. Dr Sheela Sharma Cancer Hospital, Mathura, Cancer and Palliative Care district hospital, Ujjain, Cancer District Hospital, Junagadh, GMER, Gujarat, Cancer District Hospital, Rewari, Sarvoday Hospital, Greater Noida and Subharti Hospital, Greater Noida.

Strategic Technology (Including emergency/Disaster Management)

C-DAC has been a longstanding flag bearer of Atmanirbhar Bharat by virtue of having developed strategically significant indigenous systems and solutions for Defense, Space, Emergency Response, Disaster Management, and Internal Security with features like interoperability, resilience, scalability, modularity, and robustness. Various solutions developed by C-DAC in this area are as below.

Precision Instrumentation Amplifier (PRIAMP)

The product PRIAMP is a high accuracy instrumentation amplifier for measurement of critical parameters like thrust, pressure, displacement, firing current among other parameters. PRIAMP is a mission critical equipment for Static Firing Testing of rockets, which was designed and developed by C-DAC based on the requirements provided by ISRO.

The product PRIAMP was launched by Chairman-ISRO and DG C-DAC at Satish Dhawan Space Centre, ISRO, Sriharikota on September 01, 2023. This event was organized in the backdrop of Aditya-L1 mission and witnessed the participation of the top brass of ISRO and C-DAC.

Precision Instrumentation Amplifier (PRIAMP)

Rudra based SSD Storage server hardware

This product is an indigenous storage server hardware for HPC applications. The storage server is based on the Rudra motherboard. The C-DAC storage appliance is designed to provide the perfect combination of flash performance and capacity, ensuring it can adapt to evolving technology needs. The dual processor provides maximum SSD performance, while the remote DMA feature enhances throughput. A redundant power supply ensures high availability. During the period, six storage servers are integrated with PARAM Rudra, as shown in the following figure. It achieved a sequential read and write speed of 80 Gbps and a random read and write speed of 2,500 KIOPS.

Simulator for Echosounder, EMLog and DVL(SEED)

Simulator for Echo sounder, DVL and EMLog design, shape and size of the system should be compatible with the systems to be fitted onboard submarines. There are three systems in this project. 1) Simulator for Echosounder: Echosounders are commonly used in submarines to measure water depth and below the keel of the ship, 2) Simulator for Electromagnetic Log: EMLog is navigational equipment used to measure speed and distance travelled by a

submarine and 3) Simulator for Doppler Velocity Log (DVL): A DVL is an underwater acoustic instrument used to measure the speed and direction of a moving underwater vehicle relative to the seabed or water around it. During the period, six units delivered to RCI, DRDO, Hyderabad.

Simulator for Echosounder, EMLog and DVL(SEED)

Multi-channel Acousto-Ultrasonic Non-Destructive Test System

The product is for Non-Destructive Testing and Evaluation of materials, using Sonic and Ultrasonic frequencies, optimized for porous and composite materials where conventional high frequency ultrasonic systems cannot meet the requirement. The system is commonly used for inspection of materials used in rockets and space vehicles. It is a system for Non-Destructive Testing and Evaluation of materials, using Sonic and Ultrasonic frequencies. User can measure the velocity of a sonic-ultrasonic wave through the test specimen, and the attenuation of the wave in the material. The system can be used for detecting internal flaws in test specimens, as well as for studying the characteristics of materials under test. Dual channel model of AUS series, is suitable for use in safety critical applications. It has features built in for use in NDT activities in explosive handling areas.

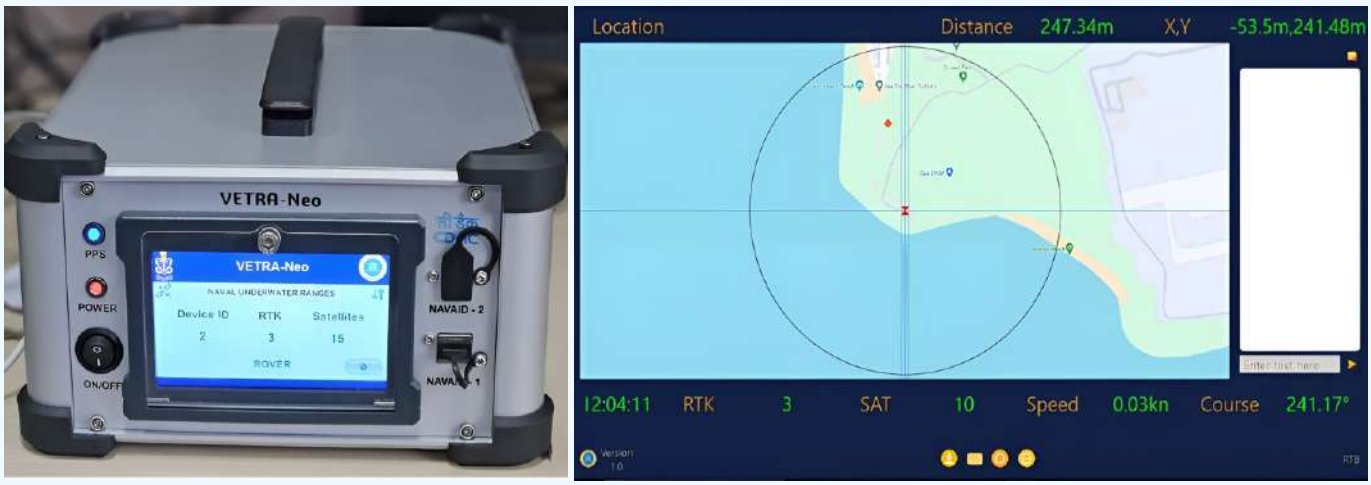
One unit is installed at High Energy Material Research Laboratory (HEMRL), DRDO, Pune on October 19, 2023.

Multi-channel Acousto-Ultrasonic Non-Destructive Test System

Vessel Tracking System -Neo - VETRA-NEO

VETRA-Neo is an advanced DGPS positioning system equipped with a multi-frequency GNSS receiver and a high quality UHF radio modem, capable of providing centi-meter level accuracy in RTK mode. VETRA-Neo system mainly consists of a base unit, installed at a pre-surveyed point on the land, and one or more rover units placed on the moving platform (vessel) whose position needs precise monitoring. Vessel Tracking System-Neo is developed for Indian Naval applications. VETRA-Neo operates on the principles of Differential Global Positioning System (DGPS), a technique that enhances the accuracy of standard GPS positioning. In DGPS, the base unit serves as a stationary reference station with known coordinates, while the rover units on the moving platform receive signals from both GPS satellites and the base unit. The system compares the rover's actual position with the known position of the base, identifying and correcting any satellite signal errors, atmospheric disturbances, or clock inaccuracies. This correction information is then transmitted from the base unit to the rover units through the high-quality UHF radio modem. The rover units utilize this correction data to refine their GPS positions, significantly improving accuracy. VETRA-Neo's advanced DGPS system employs a multi-frequency GNSS receiver, allowing it to mitigate the effects of signal reflections and other sources of interference, resulting in precise positioning even in challenging environments. The product is a shipborne differential GPS system that enables positioning within 1 cm accuracy.

This equipment is deployed by Indian Navy at Under Water Ranges Goa. 10 units were delivered as a part of the project.



Vessel Tracking System -Neo - VETRA-NEO

Echosounder for EKM submarines of Indian Navy

The Submarine Echo Sounder (SES Mk1) is a MIL-qualified navigational system designed for measuring water depth below the hull of a submarine. The transducer is fitted at the bottom hull of the submarine. This equipment is designed to meet the navigation requirements of EKM-class submarines in the Indian Navy. The system operates on the principle of ultrasonic echo sounding. It employs a dual-frequency ultrasonic transducer, with a high frequency of 210kHz for shallow water measurements up to 200 meters and a low frequency of 12kHz for deeper waters up to 6,000 meters.

First proto unit fitted in Indian Navy submarine INS Sindhusastra successfully completed one-year long sea trials, during this period.

Echosounder for EKM submarines of Indian Navy

EM Transducer-Mk1 (Digital Output)

C-DAC has successfully developed the EM Transducer (Digital). The EM Transducers (Digital) are a new concept introduced for the EMLOG System. Realizing the EM Transducer (Digital) involves designing very compact and reliable electronic circuitry for speed measurement, which resides within the dimensions of the existing EM Log transducer (Analog). Successfully developed EM Transducers (Digital) which will enable easy installation using the existing gate valve assembly, used for installing the EM Transducers (analog), without requiring costly and time-consuming dry docking of ships. Another advantage of the EM Transducers (Digital) is the compartmentalization of electronic circuitry from the transducer sensing element, ensuring easy serviceability of the electronics in the field without replacing the transducer fitted on the ship's hull. Therefore, the development of the EM Transducers (Digital) ensured compactness, reliability, and serviceability. This novel EM Log Transducer (Digital) will result in a compact, low-cost, and high-performance EMLOG System for IN platforms in the future. Successfully completed the lab demonstration of Indigenous EM log transducer (Digital) using the towing tank facility at Civil Offshore Lab, NIT, Calicut in the presence Naval officials. Successfully completed the user evaluation trial of Indigenous EM log transducer (Digital) onboard INS Kalpeni. Navy has approved the C-DAC developed EM Transducer (Digital) for induction to Naval ships.

Five Channel echosounder for nuclear submarines

The Five Channel echosounder for nuclear submarines is a MIL-qualified navigational system designed to measure both water depth and diving depth. It can also operate in stealth mode during wartime conditions. This equipment is designed to meet the navigation requirements of the Indigenous Arihant class of submarines. The system operates on the principle of ultrasonic echo sounding. It employs a dual-frequency ultrasonic transducer, with a high frequency of 210kHz and 1MHz for shallow water measurements and a low frequency of 12kHz for deeper waters up to 10,000 meters. C-DAC developed MIL qualified proto unit being installed by Indian Navy.

Five Channel echosounder for nuclear submarines

Enterprise Application Software solution for Emergency Support Services and similar helpline systems

This solution is designed to address all the emergency signals through voice call, SMS, e-mail, panic SOS signal, web portal etc. for providing services in all kinds of emergencies across the country. It encompasses a software platform designed to fully automate the operations of State Emergency Response Centre. Originally designed and developed for ERSS 112, this is customized and implemented in other helplines such as Women Helpline, Child Helpline and Disaster Helpline. The ERSS 112 Solution of C-DAC is deployed in 28 States/UTs for Ministry of Home Affairs and respective State Police Departments. During the year, Child Helpline Solution was deployed in 36 States/UTs and 470 district centres and the Women Helpline Solution was deployed in 29 States/UTs and 230 district centres.

Emergency Support Services

Advanced System for Solid Propellant Burn Rate Measurement

Advanced System for Solid Propellant Burn Rate Measurement facility was jointly inaugurated by Chairman, DRDO, Dr. Samir V Kamat and DG, C-DAC, Shri. E. Magesh at High Energy Materials Research Laboratory (HEMRL) of the Defence Research and Development Organisation (DRDO) in Pune, India on March 01, 2024. The event marked the official launch of an advanced ultrasonic system designed to measure the burn rate of solid propellants used in rockets and missiles. The product was designed and developed by C-DAC, in collaboration with ISRO, this new system represents a significant advancement in the field. Accurate burn rate measurement is critical for precisely predicting the trajectory of rockets and missiles.

Chairman of DRDO, expressed his appreciation for the innovative system and acknowledged the valuable contributions made by C-DAC in its design, development, and installation at HEMRL. He further emphasized the importance of continued collaboration between DRDO and C-DAC on similar projects in the future, with the aim of empowering the nation's defense community. This collaborative effort between C-DAC and DRDO represents a significant step forward in the development of advanced technologies for India's defense sector.

Detection, Early Warning, and Deterrence of Wildlife Species

C-DAC has developed a PoC model for Detection, Early Warning, and Deterrence of Wildlife Species Involved in Human-Wildlife Conflict (HWCM) in collaboration with Technology Innovation Hub (TIH), Indian Institute of Technology (IIT), Roorkee. Under the project C-DAC developed a product with an Acoustic and Thermal signature recorder for the detection of elephants. The product mainly consists of a signal Preprocessing Module (SPM) with two-channel programmable gain amplifier ranging from 0 to 24dB and also has a programmable cut off frequency ranging from 0 to 150kHz with the step of 10 kHz, Data Acquisition System (DAQ) and a software module for the recording of vibration, acoustic and thermal data, playback and Binary to text converter etc.

Successfully designed, implemented and tested the acoustic and thermal data recorder for the PoC model of HWCM which is used for the detection of wild elephants.

Human-Wildlife Conflict - Detection, Early Warning, and Deterrence of Wildlife Species

Digital India RISC-V (DIR-V)

In furtherance of the vision of AatmaNirbharBharat and positioning India as the global hub for Electronics System Design and Manufacturing, Government of India, MeitY launched the Digital India RISC-V (DIR-V) Program with the aim of developing a portfolio of RISC-V based Microprocessors and its compute ecosystem leading to self-reliance in microprocessor technology.

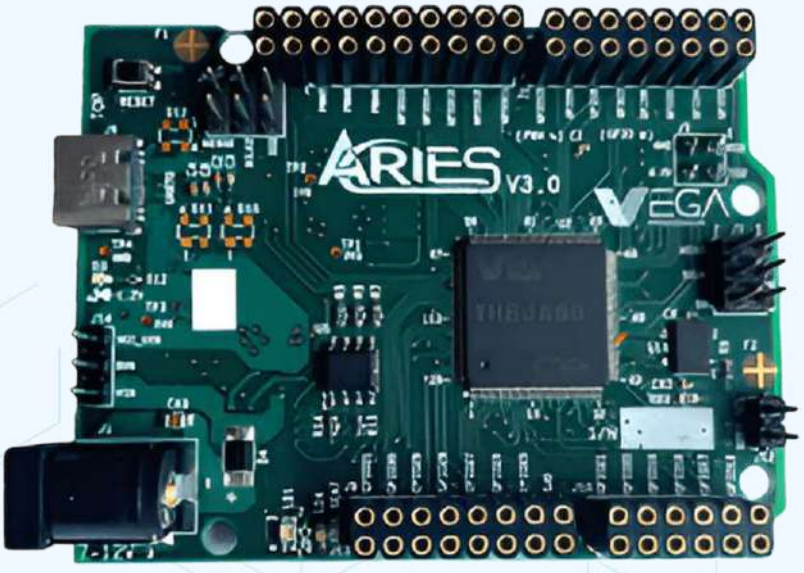
As part of the DIR-V program, C-DAC has successfully completed the design and development of the VEGA series of microprocessors including India's first indigenous 64-bit multi-core RISC-V based Superscalar Out-of-order Processor. The VEGA series comprise of 32/64-bit Single/Dual/Quad Core superscalar Out-of-Order high performance processor cores based on RISC-V Instruction Set Architecture along with a robust ecosystem. Six processors are currently available in the VEGA series. These indigenous microprocessors employing the state-of-the-art architecture have a performance which is at par with other commercially available processors are amenable for various strategic/industrial/commercial applications.

Development and fabrication of several SoC chips integrating the VEGA Processor is also envisaged. The first VEGA microprocessor-based SoC chip 'THEJAS32', a 32-bit Single core SoC has been successfully fabricated and available. 'THEJAS64' a 64-bit Single core SoC chip has been taped out to the Indian foundry SCL, Chandigarh. The design implementation and fabrication of 'DHRUV64' and 'DHANUSH64' SoC variants are also scheduled.

A development platform based on THEAJS32 ASIC, named ARIES has also been developed comprising of multiple boards. These development boards are fully indigenous and "Made in India" products which are targeted for learning, embedded system design and IoT applications. The complete ecosystem for embedded system design comprising of Board Support Packages, SDK with integrated tool chain, IDE plug-ins, Debugger for the development, testing, debugging along with support documentation are also available.

ARIES V 3.0

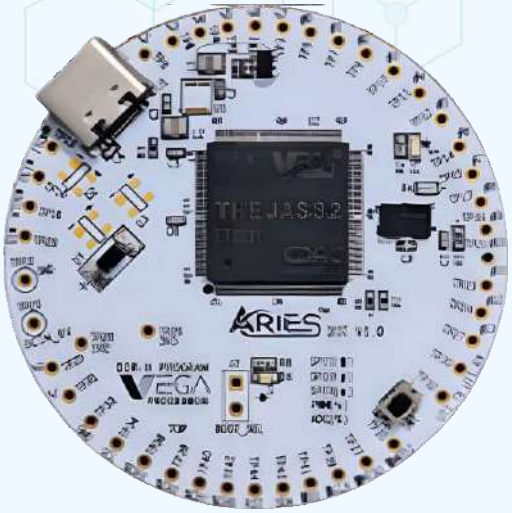
ARIES v3.0 is a development platform based on THEJAS32 ASIC operating at a frequency of 100MHz. The specifications of board include the THEJAS32 controller, 256KB SRAM, 2MB Flash, 8 PWMs, 3 SPIs, 3 UARTs, 2 I2Cs, 32 GPIOs and 4 Analog inputs. It targets a wide variety of applications, including IoT, Sensor fusion, System supervisors, Remote sensors, Legacy 8/16-bit applications, etc. Around 800 ARIES v3 boards commercially deployed at various institutes and industries.



ARIES v3.0

ARIES DOT v1.0

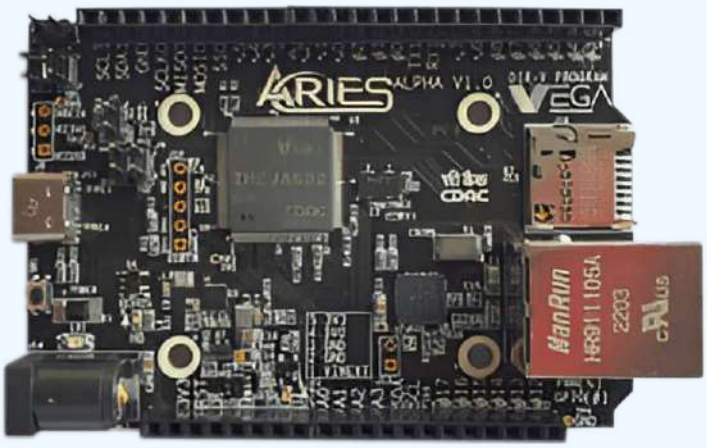
ARIES DOT v1.0 is a circular development platform based on the indigenously developed THEJAS32 SoC ASIC, integrating the DIR-V VEGA ET1031 Microprocessor. The board is 5cm in diameter and includes the THEJAS32 controller operating at 100Mhz, 256KB SRAM, 2MB Flash, 8 PWMs, 2 SPIs, 2 UARTs, 1 I2C, 14 GPIOs and 4 Analog inputs. The board is specifically designed for wearable applications and can be directly connected to wearable devices.



ARIES DOT v1.0

ARIES ALPHA v1.0

ARIES ALPHA v1.0 is a feature-rich indigenous hardware platform based on THEJAS32 SoC which includes VEGA ET1031 Microprocessor. This board is configured specifically for Ethernet, CAN and SD Card applications. ARIES ALPHA is a development platform based on THEJAS32 ASIC operating at a frequency of 100MHz. This board is targeted for a wide variety of applications, including which includes low power IoT, Sensor fusion, Smart Meter, System supervisors, Remote sensors, Wearable devices, Toy and electronic education equipment, Legacy 8/16-bit applications, Industrial networking, etc.



ARIES ALPHA v1.0

VEGA AT1051 Processor IP

VEGA AT1051 Processor IP features a 32-bit CPU IP core based on RISC-V Instruction Set Architecture. It is capable of delivering high performance with support for single precision floating point instructions, and MMU for Linux based applications. AT 1051 with a 5-stage pipeline comes with branch prediction for efficient branch execution and also includes Instruction and Data caches. The core is targeted for various applications like High-performance embedded, Consumer Electronics and Industrial Automation. The VEGA AT1051 Processor IP is available for licensing.

Design Linked Incentive Scheme

The Design Linked Incentive (DLI) Scheme aims to provide financial incentives as well as design infrastructure support across various stages of development and deployment of semiconductor design for Integrated Circuits (ICs), Chipsets, System on Chips (SoCs), Systems & IP Cores and semiconductor linked design with an aim to achieving significant indigenization in semiconductor and electronic products and IPs deployed in the country. The target segment for the scheme covers Startups, MSMEs, and Domestic Companies.

C-DAC, Noida is the Nodal Agency for the implementation of the DLI Scheme. The third roadshow was organized by C-DAC & MeitY in 2023 in the presence of Shri Rajeev Chandrasekhar, Hon'ble Minister of State for Electronics & Information Technology and Skill Development & Entrepreneurship, Govt. of India aiming to stimulate the next-gen Semiconductor Designers, Promote the culture of Co-development and joint ownership of IPs with active industry participation and Indigenously Develop Semiconductor Chips for Automobile, Mobility, Communication & Computing. As on March 2024, a total of 38 applications were received for financial support under DLI and 29 applications were received for access to the EDA Tools from the National EDA Toolgrid setup at ChipIN centre.

Chips to Start-up (C2S) Programme

To meet the increasing requirement of semiconductor design engineers, Chips to Startup (C2S) Programme has been initiated by MeitY on 28th December 2021 with an aim to train 85,000 number of Specialized Manpower over a period of 5 years at 100 participating institutions (including Academia, R&D Organizations, Startup, MSME) in the area of VLSI and Embedded System Design at Bachelors, Masters and Research level and act as a catalyst for growth of Start-ups involved in fabless design.

Under Chips to Start-up (C2S) Programme Support - 100 Institutes, 13 Start-ups/MSMEs are supported financially, Various FPGA boards identified and recommended by the CEPC were procured and distributed to all 100 participating institutes under C2S Programme, more than 200 organizations are supported for the EDA tool support including institutes supported for funds. Synopsys, Cadence, Siemens-EDA, Ansys and Keysight EDA Tool Licenses under C2S Programme are successfully installed and hosted at ChipIN Centre, C-DAC Bangalore. A total of over 100 EDA tool technical training sessions have been organized for all participating institutions so far.

ChipIN Support Center Web-Portal has been enabled for Participating Institutions to make use of the support ticket system in order to streamline ChipIN support requests. Complete archives and history of all support requests is available on the website. All vendor interactive technical EDA Tool training sessions recordings, documentation was shared to the C2S institutions through ChipIN Cloud. The material includes Presentation Slides, Installation Manuals, Demo Videos, recording of full Session Videos (which covers Q&A as well), etc. Conducted 5-day IEP on Digital ASIC Design using 180nm PDK in Hybrid mode with the participation of 83 (In person) members from various C2S participating institutes to get trained on the aspects of Digital design. IEP sessions were conducted from February 12-16, 2024 at C-DAC Bangalore.

Software Technology (Including Cloud & BOSS)

Software technologies play a vital role in shaping the modern world, driving innovation, and improving the efficiency of various industries. By using advanced software solutions, one can automate processes, enhance productivity, and provide better services. Software technologies help streamline operations, reduce costs, and enable real-time data analysis, leading to informed decision-making. The significance of software technologies lies in their ability to transform traditional practices, making them more agile, scalable, and responsive to changing needs. This transformation empowers ideas, individuals and governments to achieve greater efficiency and effectiveness in their respective domains. Various solutions developed by C-DAC in this area are as below.

Management Systems

COPS NetrA –Asset verification & Auditing tool

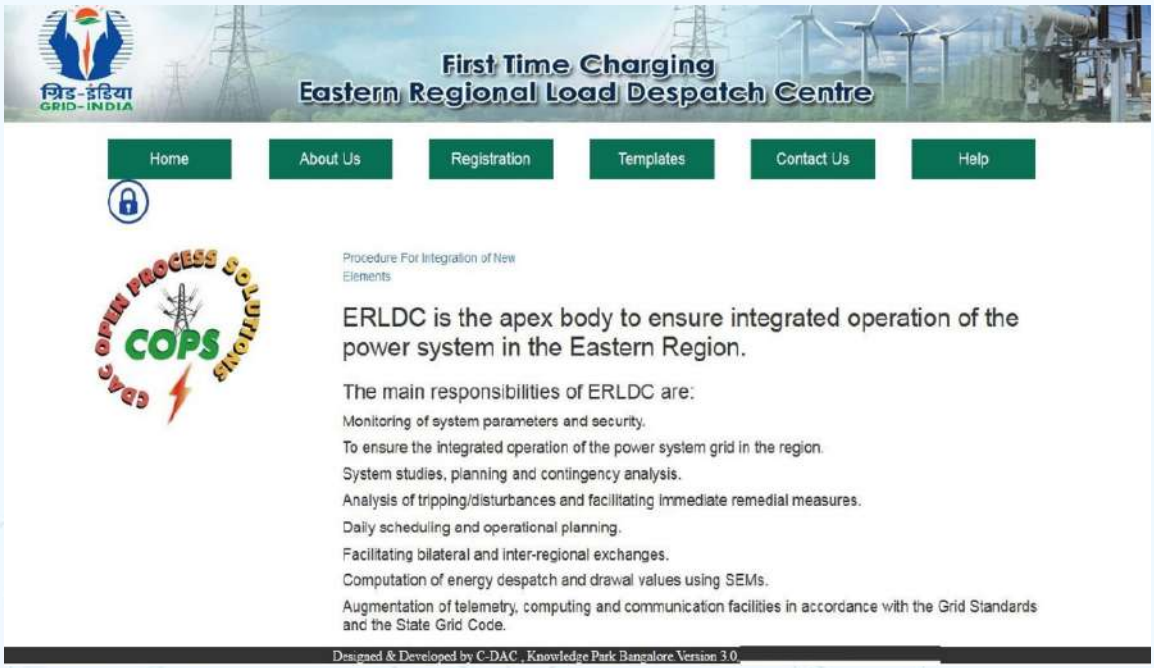
COPS NetrA - Asset Verification and Auditing Tool is designed and developed by C-DAC to streamline and automate the asset verification and audit process for network-connected devices. The tool features include audit window creation, device identification, mapping of scanned assets, manual entry verification, and report generation.

SAMPADA - Deviation settlement mechanisms accounting software 2.0

Developed by C-DAC, SAMPADA Software provides a web-based solution for bill payment and settlement for Western Regional Load Dispatch Centre (WRLDC). This tool addresses the need for efficient financial management in the energy sector by offering features such as uploading different categories of bills and bank statements online, processing bills through mapping and disbursement, and generating interest and refund amounts for each pool member. Developed to streamline these processes, SAMPADA is utilized by WRLDC, GRID-INDIA, Mumbai, enhancing financial accuracy and operational efficiency.

Web-based software for First-Time Charging (FTC) of transmission elements

The FTC Software implemented by C-DAC is a web-based solution for the First Time Charging of transmission elements workflow. It consists of submitting applications online, processing applications and sending approvals, forwarding and receiving consents from various departments of the Eastern Regional Load Dispatch Centre and national load dispatch center. The system was launched on June 09, 2023 at ERLDC, GRID-INDIA, Kolkata.



Web-based software for First-Time Charging (FTC) of transmission elements

Armament Inspection Information System (AIIMS) for Indian Navy

The Armament Inspection Information Management System (AIIMS) is developed by C-DAC in collaboration with the Indian Navy. The objective of AIIMS is to automate the management of inspection related information. It primarily pertains to making record keeping more accurate and efficient thereby raising the quality assurance standards, being able to draw inferences based on availability of historic data at the click of a button, to be readily able to assess the present status of inspection and ammunition/ munition availability, etc. The overall implementation and monitoring management of AIIMS system includes development and integration of AIIMS with existing naval applications and infrastructure, project monitoring and governance.

System Software

BOSS 10 Secured OS

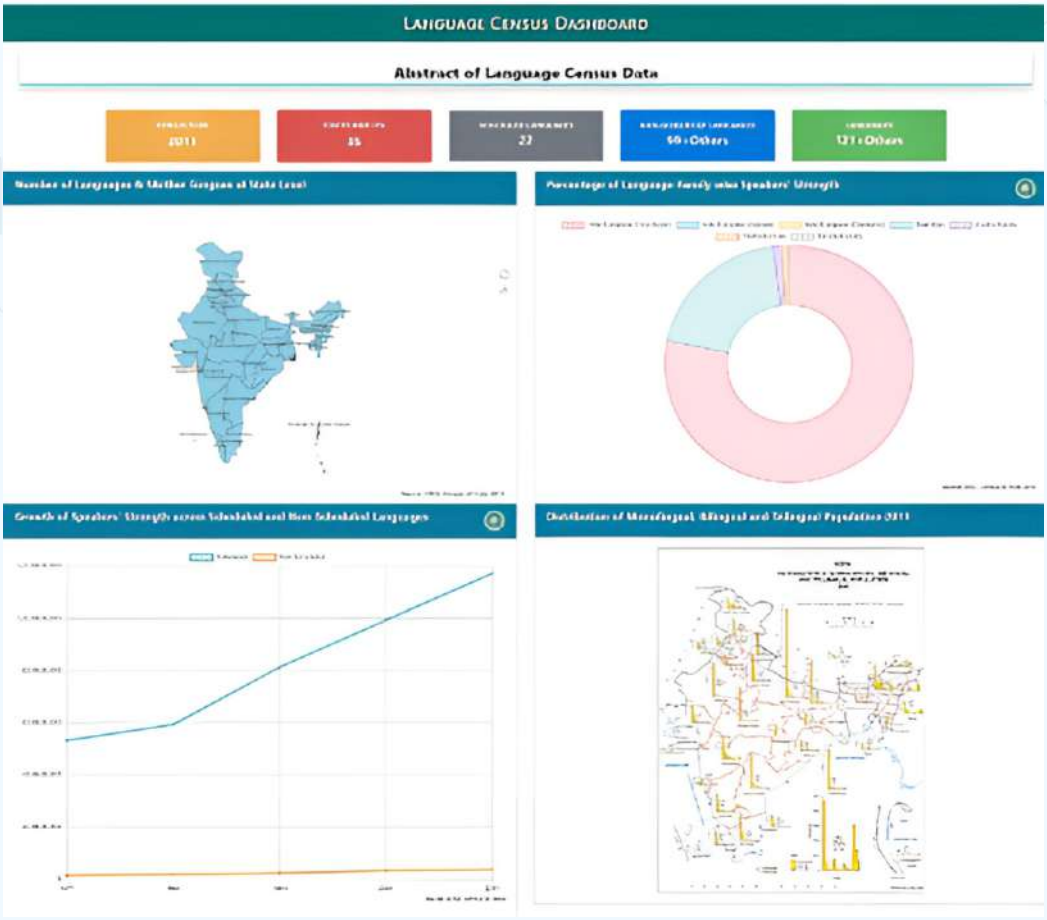
BOSS 10, code-named 'Pragya', is a customized secure GNU/Linux Operating System designed for the Indian Army and general use. It incorporates the latest kernel for device compatibility, integrates drivers, and supports a wide range of IT peripherals and hardware components. Pre-configured to comply with Army cyber audit policies and National Institute of Standards and Technology (NIST) standards, it features disk encryption, an integrated Log Management Server, Policy Management Server, and an Internet Operations Management Dashboard. It also supports automatic updating of patches and security updates, blocks external USB storage and Bluetooth, and communicates with the Internet Security Operations Centre (ISOC) for log and policy management. The user-friendly Cinnamon desktop environment, support for Indian languages, a repository of over 30,000 packages, and integration with the LibreOffice Suite and commonly used applications enhance its usability for diverse needs.

BOSS 10, 'Pragya'

Data Analytics and Visualization

Language Data Digitization and Repository System

Language data digitization and repository system is a web-based solution implemented by C-DAC for data analytics & visualization. This solution integrates archived Language Census Data with real-time data, offering analytics and visualization comprising interactive e-charts and e-maps enabling easy decision support. The solution offers mapping of unstructured data into structured schema and can be viewed over the internet. It features interactive visualization, data representation in dynamic maps, data analysis (up to district level), dynamic report extraction in multiple formats, and e-Archives.

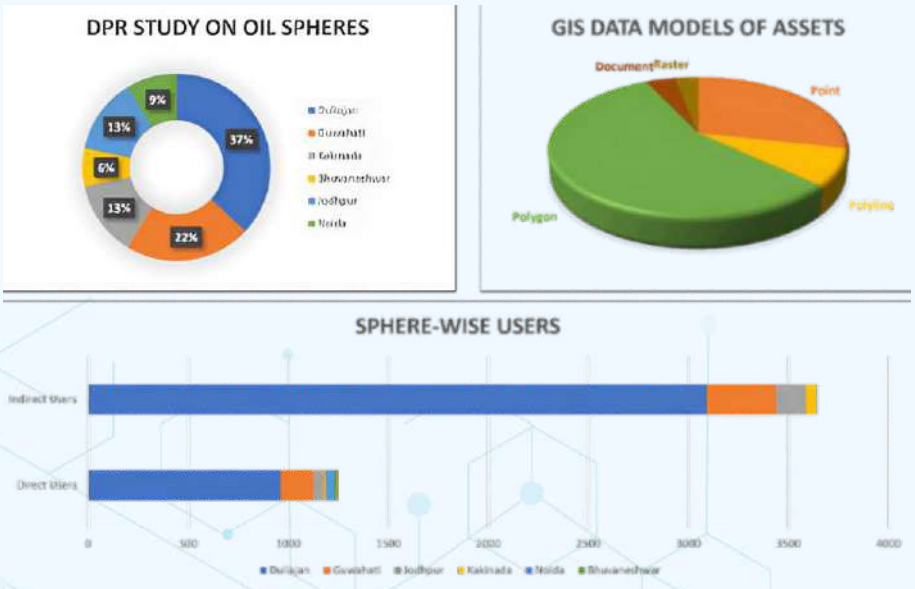


Language Census Dashboard

Geographic Information System (GIS)

GIS-based Asset Management Report Preparation

Oil India Limited (OIL) is a leading Exploration & Production (E&P), contributing around 9% to the nation's crude oil and natural gas production. To optimize operations, OIL has initiated a Companywide GIS-based Asset Management Information System (AMIS). C-DAC conducted DPR studies across key locations, including Field Headquarters in Duliajan, Pipeline Headquarters in Guwahati, and others. The detailed project report prepared by C-DAC outlines the implementation of the GIS-based AMIS, ensuring streamlined asset management across all facilities.



GIS-based Asset Management Reports

Language and Speech Signal Processing

Transliteration and Name Matching Software

C-DAC has implemented a transliteration and name matching software which is used by various entities. Maharashtra Information Technology Limited (MAHA-IT) is in the process of creating Maharashtra Unified Citizen Data Hub (MH-UCDH) aimed at the digital delivery of schemes for Government of Maharashtra. The said initiative of the MAHA-IT will be using C-DAC's language software to facilitate transliteration and name matching within the application, enhancing the delivery of schemes to citizens. Additionally, name matching algorithms will be employed for the National Farmers Welfare Program Implementation Society. C-DAC also offers transliteration software for the Office of the Registrar General of India (ORGI), capable of converting names and addresses between English and 10 Indian languages.

Kanthasth 2.0

Kanthasth-2 developed by C-DAC is a software-aided translation system that helps in the translation from English to Hindi and vice versa. The Translation Memory is a database for storing translated content in aligned pairs of source and target language segments, provided as a service to SEBI, ICG, Ministry of Defence, Government of India. During the Hindi Diwas Samaroh 2023 & the third Akhil Bhartiya Rajbhasha Sammelan in Pune, Maharashtra, in Sept 2023, Honourable Union Minister of State Shri Ajay Kumar Mishra and Dy. Chairman, Rajya Sabha Shri Harivansh launched Kanthasth 2.0 service with e-Office. Integrated with e-Office, Kanthasth-2.0 by C-DAC is utilized by over 13,000 users from various Ministries, Departments, PSUs, banks, etc.

Shrutlekhan-Advance for Hindi/English at SEBI

Developed by C-DAC in collaboration with SEBI, Shrutlekhan-Advance software enables Securities and Exchange Board of India (SEBI) personnel to prepare documents, email, notes etc. through dictation. The scope of the proposed project involves the customization and deployment of AI powered Shrutlekhan-Advance Speech-to-Text [Hindi & English languages] software for the Securities and Exchange Board of India (SEBI). The software converts spoken stream into text form, and it augments the officials to prepare the documents in fast and efficient manner with minimal keystroke. The software aims to enhance productivity and accuracy in documentation processes at SEBI.

English language to Indian language Machine Translation (EL-ILMT)

The English to Indian Languages Machine Translation System is a project initiated by C-DAC with the goal of creating a comprehensive translation service for translating English and several Indian languages, including Hindi, Marathi, Gujarati, Odia, Kannada, and Malayalam languages and vice versa. The primary domain for this system would be Governance and Policy, with secondary domains including Science and Technology, Education, Health, and Agriculture. The outcome will be a text-to-text Machine Translation system capable of translating between the specified languages. Machine Translation solutions will be provided as APIs/REST services for integration into various language-related projects and research endeavors. The developed models will be accessible as web REST services implementing the ULCA open API.

Bhashanet

BhashaNet portal is a joint initiative of C-DAC and National Internet Exchange of India (NIXI) and Ministry of Electronics and Information Technology (MeitY) which acts as a knowledge repository, increasing UA awareness, engaging stakeholders, and providing learning resources related to Universal Acceptance (UA) and multilingual internet. The portal facilitates a multilingual internet environment, enabling access to website names and email addresses in all 22 official Indian languages. Its features include UA compliant Multilingual portal, support for search in Indian languages, SOPs for multiple technologies/tools, and a ticket-based technical support system for addressing UA-related issues and queries.

BhashaNet portal

Software Development for various domains

NOC Approval for New Drug and Inoculation System (NANDI)

The portal for veterinary product approvals was developed by C-DAC and aims to streamline the approval process through seamless integration with the online systems of the Central Drug Standards Control Organization. The portal allows firms to apply for and obtain the required approval electronically, track the status of requests through email notifications, respond to queries, and print the approved certificates online. It has improved the response time for various activities and enabled faster processing. The launch of the NANDI portal is another notable undertaking following the animal vaccination coverage initiative and Mobile Veterinary Units (MVUs). The NANDI was launched in June 2023 by the Union Minister of Fisheries, Animal Husbandry and Dairying (DAHD), to enhance the transparency of the regulatory approval process for veterinary product approvals.

NANDI Portal

National Knowledge Portal "The Repository - Indian Textiles and Crafts (RTC)"

RTC knowledge portal implemented by C-DAC provides interactive digital platform for showcasing the creativity, diversity, & rich traditions of Indian textiles, clothing, and crafts. The key features include comprehensive search for textiles and crafts, craft atlas, virtual galleries, chatbot, artisan profiles etc.

Traditional Knowledge Digital Library

Traditional Knowledge Digital Library (TKDL) implemented by C-DAC is a software system aimed at digitizing and making accessible the traditional medicinal knowledge of Indian Systems of Medicine, including Ayurveda, Siddha,

Unani, Sowa Rigpa, and Yoga, with the assistance of modern ICT technologies to global patent offices. The system provides functions for creating, editing, and validating formulations while digitizing prior arts. It tracks third-party patent applications to prevent the fraudulent grant of patents on existing Indian Traditional Medicinal Knowledge. Additionally, the system provides access to a vast repository of formulations validated by eminent experts in the field of Indian Traditional Medicinal Knowledge.

Legal Metrology Application using Open-Source Technology

Legal Metrology Application developed for Government of Haryana automates the license generation process of Legal Metrology, which includes the submission of applications, area-wise allocation of inspectors for verification, online fee payment, and license generation. Users and Admins can check the status of the application at each level. Additionally, the Super Admin (CLM) can manage each activity of an application for the Government of Haryana.

GUI Development for MTA Quantum Chemistry Code

The Problem-Solving Environment (PSE) for Molecular Tailoring Approach (MTA) software developed by C-DAC is a web-based platform designed to compose and execute High Performance Computing (HPC) applications on National Supercomputing Mission (NSM) clusters. Users input software details, select an HPC machine, and provide data for execution. The PSE then runs the chosen application on the HPC platform, allowing users to retrieve output results and check job statuses. This project integrates the MTA with the PSE, deploying it on NSM clusters, offering scientists and researchers access to parallel hardware and ab initio software for quantum chemical investigations on complex molecules and clusters via a user-friendly GUI/web interface.

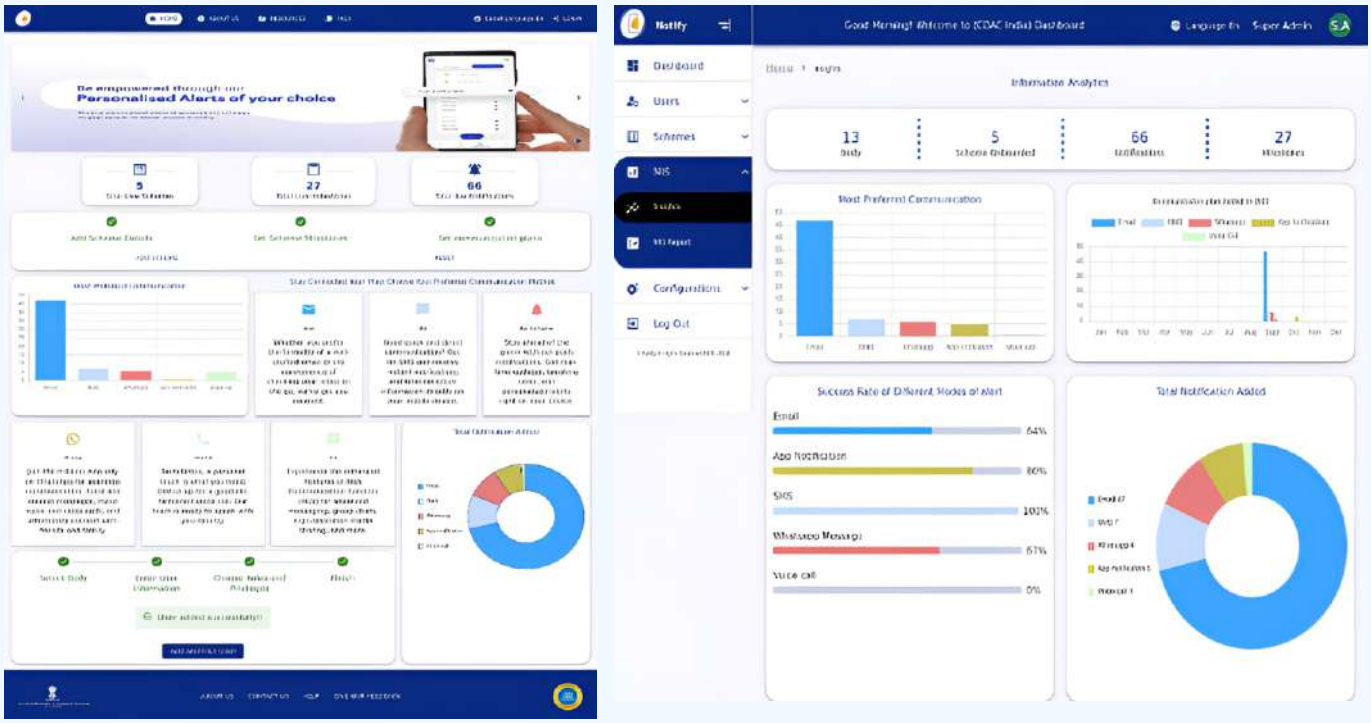
E-Governance

E-Governance plays a crucial role in modernizing public administration, enhancing the efficiency and transparency of government services, and ensuring better citizen engagement. By leveraging technology, e-Governance initiatives aim to streamline processes and provide timely and accessible services to the public. The importance of e-Governance lies in its potential to transform the way governments interact with citizens, businesses, and other stakeholders, leading to more responsive and accountable governance. Various solutions developed by C-DAC in this area are as below.

e-Governance Systems & Applications

Notify Platform

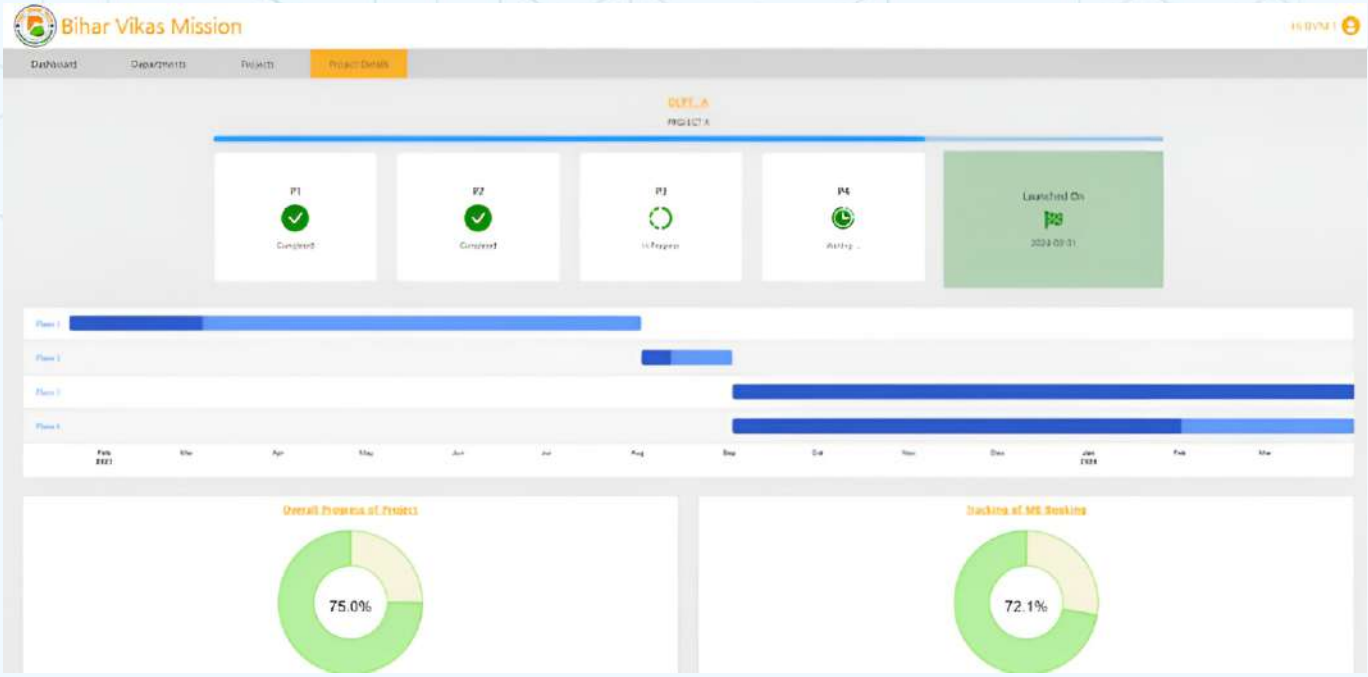
C-DAC has developed 'Notify', a notification framework for Ministry of AYUSH. This all-encompassing framework is designed to create, send and manage multimodal notifications ensuring seamless personalized communication across various channels including SMS, App (mobile/web), social media (starting with WhatsApp), Voice calls, and Email, with real-time reporting. Notify's web application enables multiple stakeholders to onboard agencies/institutions, configure services/programs, establish milestone-specific communication plans, execute them and monitor analytics through a user-friendly dashboard. Key modules include User Management, Service Management, Communication Plan Management, Scheduler, and MIS. Currently deployed for the National Medicinal Plants Board (NMPB) under the Ministry of AYUSH, Notify's capabilities serve personalized notifications within the eCHARAK application.



'Notify', a notification framework

Civil Works Pendency Index (CWPI) – Phase I

Civil Works Progress Index (CWPI) is an advanced dashboarding and alert management system implemented by C-DAC for Bihar Vikas Mission, Government of Bihar. It is designed to monitor civil work progress, identify bottlenecks, and offers solutions for efficient scheme implementation. Key features of CWPI includes an authentication module, analytics dashboard, and project monitoring with an alert system. Deployed at Bihar Vikas Mission, Government of Bihar, it automates data monitoring for real-time project tracking and departmental performance comparison, enhancing project oversight, timely issue identification, and scheme implementation efficiency.



CWPI - dashboard and alert management system

Wood Based Industries Licensing System (eSolution for Forest Department)

Developed by C-DAC, in collaboration with various state forest departments, the Wood Based Industries Licensing System addresses the need for streamlined and transparent management of wood-based industry licenses. The system continually evolves and introduces new features to enhance its functionality. Together with its existing capabilities, such as process automation and citizen convenience with e-services, it added comprehensive license lifecycle monitoring, offering valuable insights into the progress and status of fresh and existing license applications. With integrations like Aadhaar-based eSign, Lottery, SMS, and payment gateway integrations, the system ensures more efficiency and transparency. It has been successfully deployed in the forest departments of Haryana with approximately 7000 licenses issued, Uttar Pradesh with approximately 6000 licenses issued, Punjab with approximately 4000 licenses issued, and launched in West Bengal in April 2023.

Wood Based Industries Licensing System

e-Pramaan Single Sign On

e-Pramaan, implemented by C-DAC is a nationwide initiative conceptualized and funded by the Ministry of Electronics and Information Technology (MeitY), Government of India, enables Single Sign-On and e-Authentication for government services. It offers role-based access management, streamlining permissions through SSO tokens. Support for Lightweight Directory Access Protocol (LDAP) enhances compatibility with existing systems. Now, e-Pramaan also facilitates e-Sign services, simplifying document signing for Aadhaar holders. The User Consent Management System (e-Sammati) aligns with Digital Personal Data Protection (DPDP) bill 2023, allowing users to control data sharing. Departments can customize consent formats via User Consent Management System (UCMS). With 363 integrated services and 66.11 crore transactions, e-Pramaan proves its efficacy. Its SSO solution and additional services like OTP and Biometric verification are available commercially. e-Pramaan also a part of National Single Sign on platform Meri Pehchaan, facilitated by collaboration between NIC and NeGD, provides user identity verification across applications like e-Pramaan, Jan Parichay, and DigiLocker, simplifying access via various parameters to enhance user convenience and security in accessing digital services through multiple authentication parameters such as username, mobile number, Aadhaar, and PAN.

Aadhaar Authentication and e-KYC Platform

UIDAI facilitates real-time authentication and e-KYC using Aadhaar. However, this authentication and e-KYC are allowed through Authentication User Agency (AUA) and Authentication Service Agency (ASA). To facilitate authentication and e-KYC, AUA is expected to implement the necessary software in compliance with UIDAI, routing the transaction to UIDAI through ASA, which is permitted to connect to the UIDAI Central Identity Data Repository (CIDR). Indian Oil Corporation Limited (IOCL) utilizes the AUA and ASA software framework developed by C-DAC to offer Aadhaar Authentication and e-KYC platform for LPG beneficiaries, conducting over 7.4 crore authentications in the year 2023-24. The framework provided at IOCL Data Center also includes Aadhaar Data Vault, software for secure management of Aadhaar Numbers as per UIDAI guidelines. Centre for e-Governance (CeG) Karnataka also has an instance of this solution to cater the need for Aadhaar authentication and e-KYC to its residents availing beneficiary schemes in the Karnataka state processing 23.3 crore transactions in the year 2023-24. The M.P. State Electronics Development Corporation Ltd has issued a work order to C-DAC for the utilization of the ASA component of the framework.

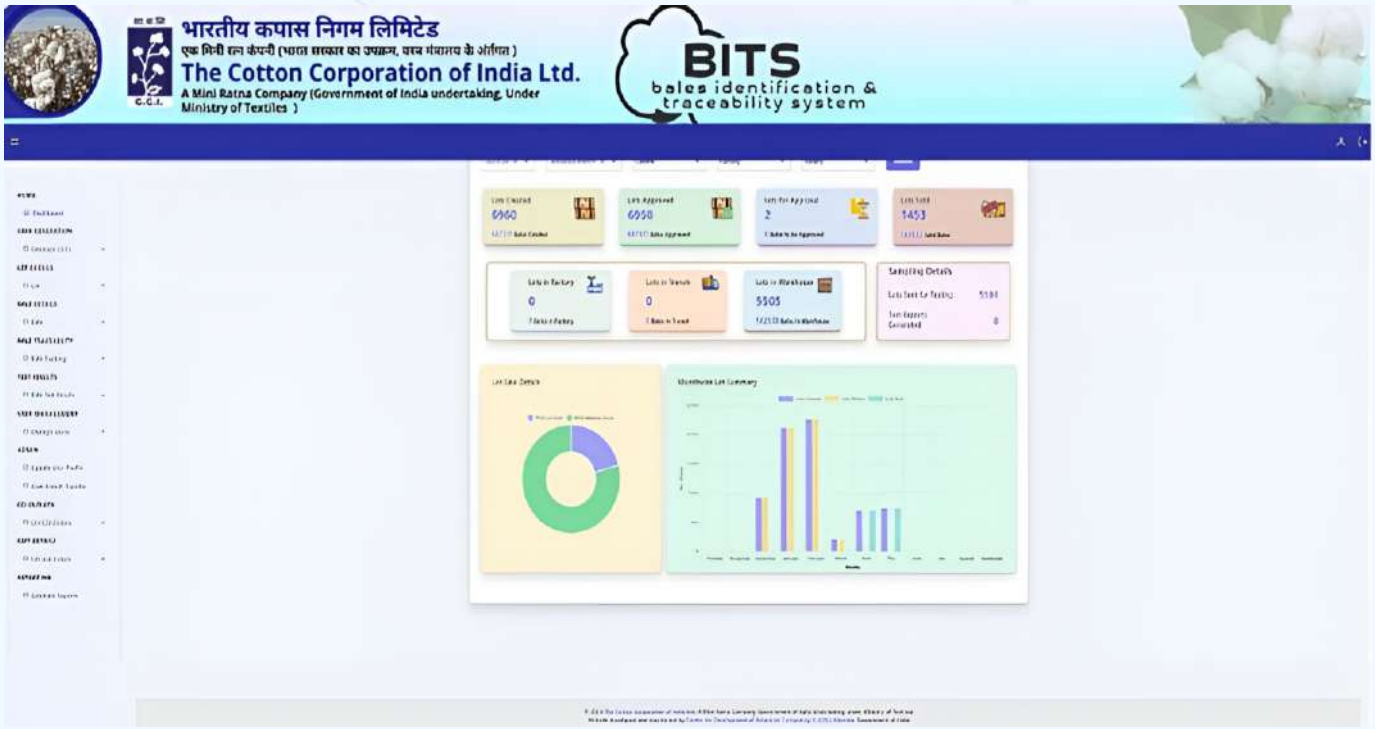
Blockchain Based Framework & Systems

National Blockchain Framework

C-DAC has developed the National Blockchain Framework which is funded by the Ministry of Electronics and Information Technology (MeitY), aims to prepare India for widespread adoption of Blockchain technology, ensuring trust in e-Governance applications. As a service, it supports an agile technology stack enabling rapid and secure application development with capabilities such as end-to-end solutions, OpenAPI integration, and distributed infrastructure. Support for single and multi-node configurations, low-code development, and solid security across layers are some of the notable additions to the framework. Additionally, Fabric and Sawtooth platforms are supported, allowing for seamless integration and the flexibility of bringing one's infrastructure. Major outcomes encompass Low-Code No-Code (LCNC) advancements, smart contract development for Sawtooth, and design-pattern-based contracts for various sectors, such as certificate storage, supply chain, and medical insurance. The framework is used to build applications for certificate verification, cotton bale tracking, and domicile verification. Domicile verification as a service under the NBF is currently in progress, with its key feature being tamper-proof certificate storage on the blockchain. This ensures verifiable certificate origin and facilitates easy detection of certificate genuineness, effectively conflicting fraud and misuse.

Bale Identification and Traceability System (BITS)

Funded by the Cotton Corporation of India (CCI), Bale Identification and Traceability System (BITS) revolutionizes the cotton supply chain, addressing opacity and inefficiency. Developed by C-DAC, it assigns unique digital identities to each bale on the blockchain, ensuring seamless traceability. The adoption of BITS by CCI has yielded remarkable results offering stakeholders real-time access to bale origin and quality data. Key features include unique bale identification, immutable recordkeeping, and end-to-end traceability. It facilitates secure data sharing, promoting collaboration and reducing disputes. BITS enables data-driven decision-making and supports brand reputation and consumer trust. The product was unveiled on World Cotton Day, October 7, 2023, by Secretary of Textiles, GOI, in Delhi.



Bale Identification and Traceability System (BITS)

Standards & Guidelines

e-Governance Standards and Guidelines

Under the aegis of Ministry of Electronics and Information Technology (MeitY), Government of India, C-DAC in collaboration with Standardisation Testing and Quality Certification (STQC) Directorate has been entrusted to develop / review ICT Standards/Guidelines/Frameworks for e-Governance projects under Digital India. The major achievements during the period includes constitution of working groups on topics like Cloud Inter-operability and Portability, Enterprise Architecture Security, and Metadata Standards for various sectors. Additionally, a Working Group on Online Learning and Examination System was re-constituted. C-DAC conducted eight state-level awareness workshops and one at Maulana Azad National Urdu University to shed light on MeitY's standards, guidelines, and technologies to industry, academia, and government stakeholders, including students.

Healthcare Technologies

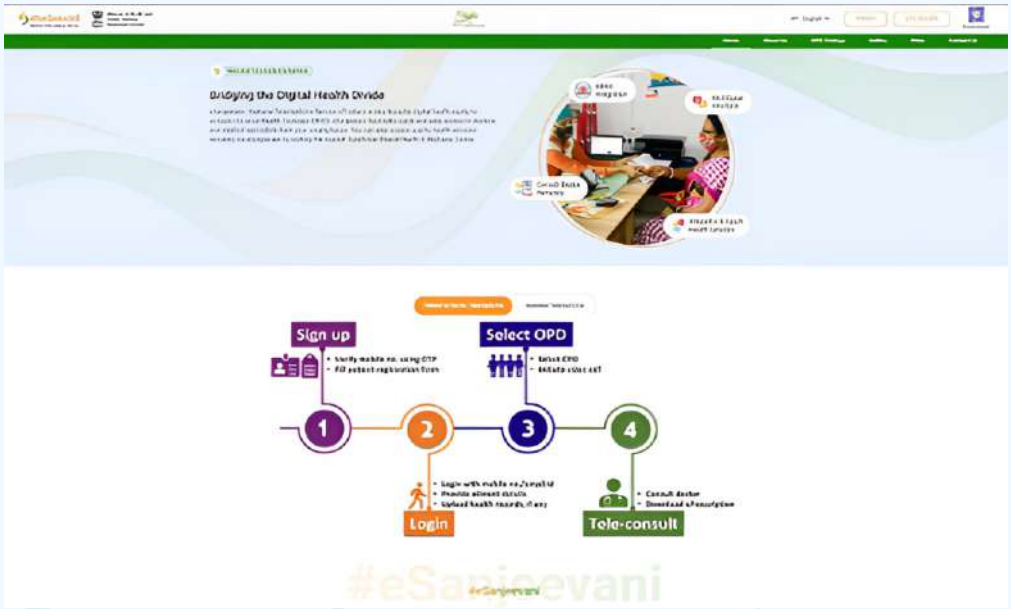
Healthcare technologies have played a significant role in improving the quality of life across society in recent years. C-DAC's Techno Healthcare Solutions, including applied healthcare solutions and healthcare informatics, have immensely contributed to the goal of making affordable and quality healthcare accessible to the public. Quick and easy access to solutions on smart devices has enhanced the adoption of these technologies among doctors and medical specialists. This, in turn, has contributed to the development of standards and best practices for various healthcare technologies. The initiatives carried out by C-DAC in the last year have significantly advanced health technology and related activities as given below.

Key impact initiatives

eSanjeevani - National Telemedicine Service

eSanjeevani - National Telemedicine Service is an innovative, indigenous, cost-effective, cloud and microservices architecture based real-time web-based telemedicine system developed by C-DAC as per the requirements and workflows outlined in the guidelines for Telemedicine Services by MoHFW. eSanjeevani is implemented in two variants: 1. eSanjeevani-AAM Ayushman Arogya Mandirs (a provider-to-provider telemedicine platform): It enables the access of quality and specialized health services to rural and isolated populace in assisted mode. 2. eSanjeevaniOPD (a patient to provider telemedicine platform): it empowers citizens to access health services in the confines of their homes through smartphones or laptops etc.

eSanjeevani - National Telemedicine Service is one of the crown jewels of digital India and has served over 119 million patients through 118,718 Ayushman Arogya Mandirs (AAM) as spokes which are served by 14,825 hubs and 364 online OPDs with support of more than 57,289 doctors, medical specialists, super-specialists and health workers. 'eSanjeevani' has emerged as the world's largest telemedicine implementation in primary healthcare. Countries like Fiji, The Philippines, Sri Lanka have expressed interest in eSanjeevani. At present, eSanjeevani is available on Ministry's web portal and also on Google play store.



eSanjeevani web portal

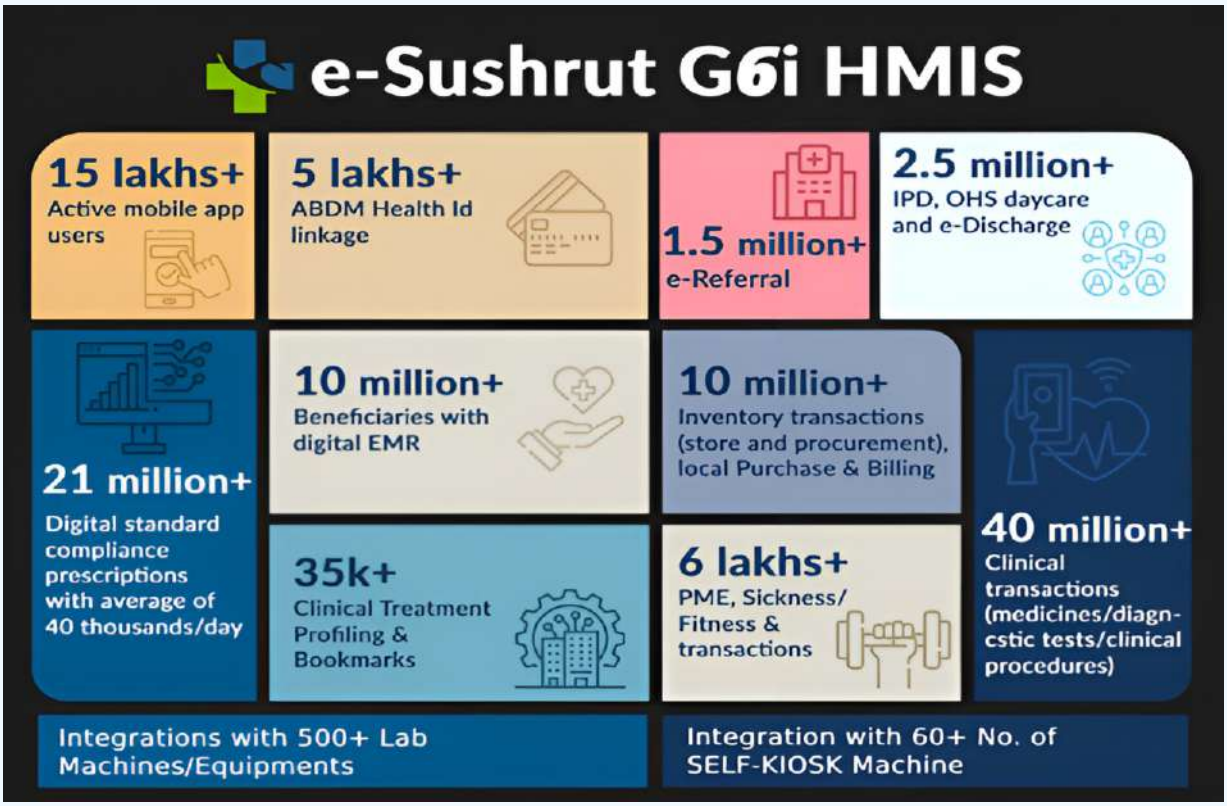
e-Sushrut - Hospital Management Information System – HMIS

e-Sushrut - HMIS developed by C-DAC, incorporates an integrated computerized clinical information system for improved Hospital administration and patient health care record Management. It provides an accurate, electronically stored medical record of the patient. Real-time e-Sushrut streamlines the treatment flow of patients and simultaneously empowers workforce to perform to their peak ability, in an optimized and efficient manner. e-Sushrut

HMIS is used by State of Maharashtra (700+ Health Facilities – DH/CHC), State of Punjab (500+ Health Facilities – DH/Mohalla Clinics), Indian Railway Hospitals (700+ Health Facilities-Central Hospitals/Divisional Hospitals/Clinics), 16 AIIMS, SAIL Bokaro, SAIL Rourkela, NIMS Hyderabad in the year 2023-2024. At present e-Sushrut HMIS is being rolled out in more than 4000+ Health Facilities in India. During the year, C-DAC initiated several rollouts of the e-Sushrut HMIS, including statewide implementations in Himachal Pradesh, covering over 50 health facilities (MCH/DH/CHC), and in Tamil Nadu, covering over 100 health facilities (MCH/DH/CHC/AH). Additionally, the system was rolled out at AIIMS Jodhpur and AIIMS Jammu, Jawahar Lal Nehru Hospital & Research Center SAIL Bokaro, PGIMER Chandigarh, and IGIMS Patna.

Additionally, few other modules such as Industrial and Occupational Health Management Information System (I&OHS HMIS) as part of e-Sushrut HMIS – PSU Instance to meet the unique needs and requirements of occupational health professionals, employers and employees in industries such as railways, manufacturing plants, hydro power plants, mining, nuclear plants and other work environments with potential health risks.

Industrial Contract & Outsource Worker (CWHC) Health Check-up has been launched as part of e-Sushrut HMIS – PSU Instance to facilitate the management and tracking of health checkups for contract workers in industrial settings for PSU's Hospitals. C-DAC continually works on enhancing e-Sushrut, adding new features, improving user experience, and ensuring compliance with the latest healthcare standards and regulations.



e-Sushrut G6i HMIS achievements

e-Sushrut@Clinic (Hospital Management Information System – HMIS)

The e-Sushrut@Clinic is a lite version of e-Sushrut HMIS specially designed to accommodate OP Clinics, Independent Labs and Nursing Home and Primary Health Centers/Mohalla Clinics. It is very feature-rich, user-friendly software solution that provides superior performance and dependability in managing the end-to-end operations required in OP Clinics for effective and efficient operations. It is especially made to meet the clinical, administrative and operational needs of these Clinics. It is a reliable and secure system that can be accessed from desktop computer, laptop, tablet and Smartphone at any time and from any location. By communicating with patients via email and SMS, e-Sushrut@Clinic improves the doctor-patient connection while also strengthening the doctor-patient relationship.

eRaktKosh (Centralized Blood Bank Management System)

C-DAC developed eRaktKosh as a centralized web-based application to manage the entire lifecycle of blood donation and distribution, from donor registration to blood issuance. This ensures uniformity and standardization across all participating blood banks. The project was funded by the Ministry of Health & Family Welfare (MoH&FW), It has on boarded more than 4000+ blood banks on its platform. e-RaktKosh Portal is also extensively used by the citizens for requirements related to blood, blood banks' location identification, blood stock Enquiry, maintenance of donation repository etc. e-RaktKosh is integrated with various state-wide blood bank solutions & has become a single data repository for management of data regarding blood, blood-related products, blood donation camps, donor repository etc. e-RaktKosh application has also been integrated with Paytm and Arogya Setu for Blood Stock enquiry. In 2023-24, 175 new blood banks registered on e-RaktKosh portal, 41K blood donation camps registered and 10 lacs donors registered and provided donation e-Certificate. The portal has been recognized as the digital platform for Ayushman Bhav Sewa Pakhwada in 2023. At times of emergencies, eRaktKosh ensures a prompt response by providing real-time data on blood availability and blood bank information. It is one nation, one platform for information on blood availability and blood banks.

e-RaktKosh webportal

e-Aushadhi – Drugs and Vaccine Distribution Management System

C-DAC developed e-Aushadhi as a web-based application to manage the entire lifecycle of drugs and vaccines, including procurement, inventory management, distribution, and usage tracking. The system is designed to ensure the efficient and timely availability of essential medicines and vaccines. The main aim of e-Aushadhi-DVDMS is to ascertain the pharmaceutical needs of various district drug warehouses such that all the required materials/drugs are constantly available to be supplied to the user district drug warehouses without delay. This system is crucial for maintaining accurate records, ensuring regulatory compliance, and enhancing overall safety and effectiveness in the distribution and administration of drugs and vaccines. This solution has brought about a great impact in the area of public health, which has aided in analysing disease patterns and tracking disease outbreaks and transmission to improve public health surveillance and speed of response.

Currently, 18 States, 06 UTs, 05 Central Programs and 01 Program under Ministry of Defence are using this application. This year's additions to the list include the Directorate of Insurance of Medical Services, Telangana (DIMS-TS), UT of Chandigarh, Ladakh and Andaman and Nicobar.

e-Aushadhi – Drugs and Vaccine Distribution Management System

Ayushman Bharat Digital Mission (ABDM) Integrations Middleware

To exchange e-Sushrut generated EMR (Electronic Medical Record) with ABDM Ecosystem, e-Sushrut needs to support the building blocks of ABDM as well as Fast Healthcare Interoperability Resources (FHIR). e-Sushrut application upgraded for Health ID Generation, sharing the electronics records to Digilocker, exchange of care context with NDHM ecosystem. The Platform developed by C-DAC provides ABHA Number based Patient registration, Patient waiting time management, Crowd Management through integrated Scan and Share feature in HMIS. It is made generic so that it can be enabled in any HMIS Deployment. It also helps to reduce the patient's demographic data entry and typo mistakes. It has 2134 facilities on-board with 1987 facilities onboarded in 2023-2024. More than 47 lacs scan and share token,25 lacs patient health records linked and 18 lacs ABHA no and address created during the period 2023-2024.

The solution has been implemented at AIIMS Nagpur, AIIMS Raipur, AIIMS Bhubaneshwar, AIIMS Mangalagiri, AIIMS Kalyani, AIIMS Deoghar, AIIMS Patna, AIIMS Gorakhpur, AIIMS Bhatinda, AIIMS Bibinagar, AIIMS Rajkot, AIIMS Bhopal, AIIMS Raebareli, state instances of State implementations in Punjab, Sikkim, Goa, Arunachal Pradesh, Uttar Pradesh etcResearch in Healthcare and AI in Telehealth

Schematic representation of ABDM FHIR Connector

Research in Healthcare and AI in Telehealth

Pathways to Resilience and Mental Health

Pathways to Resilience and Mental Health is a national level task force project initiated by ICMR with an objective to institute a multi-centre, multi-disciplinary, collaborative team-science platform, to enable the longitudinal study of (a) Neuro developmental origins of resilience/vulnerability to psychopathology (mental illness) and (b) Pre-emptive and early intervention strategies to reduce vulnerability and promote resilience to mental health problems across the

lifespan. This study includes accelerated longitudinal cohort [0-26 years] assessed with repeated age-appropriate, multimodal measurements: (a) brain structure and function, psychological abilities, appetitive and other behaviours, psychopathology; (b) genotyping, epigenetic modifications; (c) gut microbiome, stress-inflammation-microglial activation; (d) environmental insults across lifespan. C-DAC contributes to the development and deployment of digital platforms aimed at providing mental health resources, and self-assessment tools..

As of March-2024, the data collection platform has been deployed at National Institute of Mental Health and Neurosciences (NIMHANS-Bengaluru) and the client-side application at 7 hospitals/institutes for data collection: a) All India Institute of Medical Sciences (AIIMS - Kalyani); b) National Institute of Mental Health and Neurosciences (NIMHANS-Bengaluru); c) Rishi Valley Health Centre, Chittoor; d) Regional Institute of Medical Sciences (RIMS-Imphal), e) Jawahar Lal Nehru Memorial Medical College (JNMMC-Raipur); f) ICMR - Centre for Ageing & Mental Health (ICMR-CAMH-Kolkata) and g) Postgraduate Institute of Medical Education and Research (PGIMER - Chandigarh).

Standards and Compliance

India AYUSH Extension for SNOMED CT

"India AYUSH Extension for SNOMED CT" focuses on integrating traditional Indian systems of medicine—collectively known as AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy)—with the global clinical terminology standard, SNOMED CT (Systematized Nomenclature of Medicine – Clinical Terms). C-DAC was responsible for developing the India-specific extension to SNOMED CT that includes terminologies related to the AYUSH systems of medicine. This involved identifying, standardizing, and mapping terms used in Ayurveda, Unani, and Siddha to the SNOMED CT framework. This extension facilitates to capture, retrieval, sharing, and analysis of clinical data within Electronic Health Records (EHR) for these domains. The India AYUSH extension is part of the National Resource Centre for EHR Standards (NRCeS) project, supported by the Ministry of Health and Family Welfare (MoHFW), Government of India. Content development for this extension is overseen by the Central Council for Research in Ayurvedic Sciences (CCRAS), the Central Council for Research in Siddha (CCRS), and the Central Council for Research in Unani Medicine (CCRUM), under the Ministry of AYUSH.

Key features of the current release include support for Ayurveda, Siddha, and Unani systems of medicine within SNOMED CT. It includes translations of SNOMED CT terms into Sanskrit, Tamil, and Urdu for these systems, enabling precise clinical coding. The release encompasses 3,365 Ayurveda, 13,654 Siddha, and 15,084 Unani clinical concepts, covering anatomical structure, clinical findings, disorders, and procedures for comprehensive clinical documentation and interoperability.

The AYUSH extension was released on May 2023, June 2023, August 2023, and November 2023. The Terminology Integrated Package is freely available to all the SNOMED CT Affiliates in India.

India AYUSH Extension - a standardized clinical terminology specific to Ayurveda, Siddha, and Unani systems

Fast Healthcare Interoperability Resources (FHIR) Implementation Guide for ABDM

FHIR Implementation Guide developed by C-DAC, provides a set of rules and guidelines to ensure consistency and compatibility in the implementation of FHIR standards across healthcare applications and systems. It provides a standardized framework for developing, sharing, and managing healthcare information exchange protocols, facilitating interoperability in health systems by defining how data is structured and exchanged.

The FHIR Implementation Guide (IG) for ABDM, based on FHIR Version R4, defines rules using FHIR resources to solve interoperability challenges. It sets minimum conformance requirements for health record artifacts exchanged in ABDM, aligning with Health Data Interchange Specifications 1.0 for continuity of care in India. The IG specifies data structures for the National Health Claim Exchange and provides examples for creating structured data, and promoting standardized health information exchange across healthcare systems. Multiple versions of the FHIR Implementation Guide (IG) for ABDM are regularly released to accommodate requirements. The IG for ABDM had 06 releases between April 2023 - March 2024 to support the National Health Claim Exchange (NHCX) between healthcare providers and payers integrating more than 40 insurance companies and enabling sharing of Invoice Record to onboard Pharmacies to the ABDM.

Toolkits & SDKs for integration of Digital Health Standards

C-DAC develops Free and open-source (FOSS) toolkits and SDKs for easy integration of Digital Health Standards to achieve interoperability between health systems and programs within the country. The toolkits are developed for the standards, specifications, and protocols for data exchange including SNOMED CT, Digital Imaging and Communication in Medicine (DICOM), Health Level 7 (HL7) v2.5 Protocol, Logical Observation Identifiers_Names and Codes (LOINC), Fast Healthcare Interoperability Resource (FHIR) Standards as notified in EHR Standards for India (2016) by Ministry and Health & Family Welfare.

In the SDK suite, the ABDM FHIR R4 Usage Samples for Java and .NET were made available to support National Health Claim Exchange (NHCX) on January 31, 2024. More than 10500 downloads of these toolkits & SDKs are estimated as of March 2024.

Features of CSNOtk v8.0 SDK suite

System Solutions

Drug Information Authoring Tool (DIAT)

Drug Information Authoring Tool (DIAT) is a web-based application developed by C-DAC, for the collection and curation of drug information for the development of Common Drug Codes for India (CDCI). DIAT is a secured platform for users (suppliers/manufacturers, regulatory bodies, and other relevant sources) to add drugs and associated details. This includes workflow for reviewing and authoring the drug contents for completeness and correctness.

DIAT supports drug data modelling as per ISO Identification of Medicinal Product (IDMP) standards and creating unique drug codes for identification and exchange between clinical, reporting, stock, supply chain, and dispensation systems. Its latest version 3.0 is Integrated with the Ayushman Bharat Digital Mission (ABDM) Drug Registry [BETA] building block of ABDM for the drug manufacturers to add drug information for standardization.

e-Upkaran (Equipment Maintenance & Management System - EMMS)

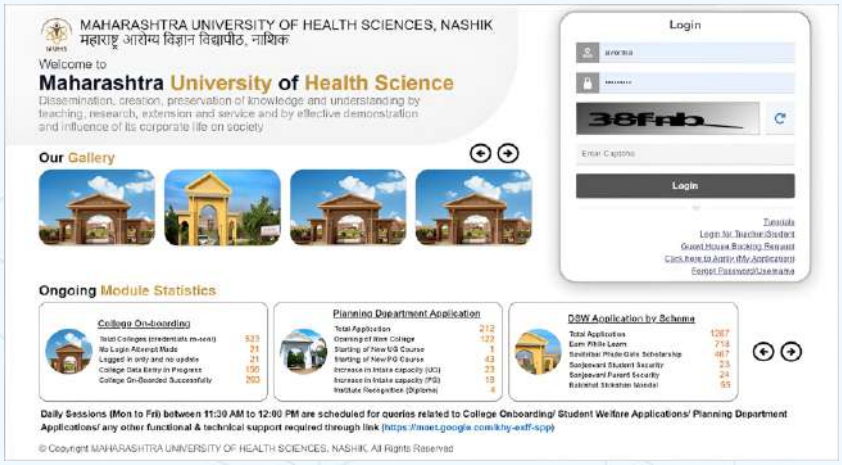
e-Upkaran is a web-based software application developed by C-DAC used to manage medical equipment life cycle (From the time it is purchased until it is condemned and put up for auction) for the equipments deployed across the States. e-Upkaran facilitates services like Equipment Inventory Management, Annual Maintenance Complaint Management, Equipment Servicing Condemnation etc. for healthcare organizations.

e-Upkaran will help to improve, monitor, speed up process related to purchase of equipment, equipment complaint management and its usage and help in better decision making in purchase, effective utilization of existing and purchased equipment which help state in providing better health services to the citizen of state. Currently, 12 States and 01 Union Terriotory are using this application. This year's additions to the list include State of Uttar Pradesh (UP), State of Karnataka and State of Assam.

e-Upkaran: Process flowchart

Maharashtra University of Health Sciences (MUHS), Nashik

Maharashtra University of Health Sciences (MUHS)-UAS is a web-based application develop by C-DAC using micro services and automating the various processes of university (Transitioning from a Paper-Based System to an Online Application Model), this improves the productivity of the university since a lot of mundane and seemingly tedious tasks that have to be conducted on a daily basis are smoothly managed by the software. This allows the management to focus and dedicate more time to academics and other events of greater importance.



Online Application Model for Maharashtra University of Health Sciences

Telehealth Solutions

Mental Health and Normalcy Augmentation System-Wellness Connectivity Program (MANAS – WeConnect)

MANAS is a comprehensive, scalable, national digital wellbeing platform, initiative by Government of India to augment the mental well-being of Indian Citizens for the age group of 15 to 35 years. MANAS can be used for self-evaluation of the mental well-being of individual using WHO scale. The platform developed by C-DAC integrates a wide range of mental health services, including counseling, therapy, self-assessment tools, and wellness resources, making it a one-stop solution for users seeking mental health support. During October 6-7, 2023, the "Codeathon and Symposium for Mental Wellness" was conducted to build capacity for the MANAS content. The event saw tremendous participation from 558 individuals nationwide, forming 223 teams guided by 63 mentors from eminent institutes.

SaQsham Portal - National Quality Assurance Standards Certification process for health facilities

National Health System Resource Center (NHSRC), under its Quality Improvement Division, has the mandate to certify public health facilities on defined standards and measuring elements implemented nation-wide, as a part of comprehensive quality assurance framework, launched by MoHFW, Government Of India, through various programs like Kayakalp, LaQshya etc. NQAS is currently available for approximately 7000 public health facilities which include District Hospitals, CHCs, PHCs, Urban PHCs and Health & Wellness Centres & Sub Centres.

In light of this, the SaQsham Portal, designed, developed, and implemented by C-DAC, is automating and integrating the entire Quality Certification process into an Enterprise Workflow System. This will streamline the National Quality Assurance Standards Certification process for health facilities across the country. SaQsham enables external assessment of primary & secondary care public health facilities i.e., DH, SDH, CHC, PHC, UPHC and HWC for NQAS, LaQshya / MusQan/Any Other Scheme/ Virtual certification. Quality Improvements (QI) division at National Health System Resource Center (NHSRC), MoHFW has been supporting the states for achieving certification in these health facilities.

SaQsham Portal

Educational Technologies

Educational technologies have become important in enhancing the learning experience, providing diverse and flexible learning opportunities, and improving educational outcomes. These technologies offer interactive and engaging tools which cater to different learning styles, making education more accessible and inclusive. By integrating digital tools, educators can deliver personalized learning experiences, foster collaboration, and facilitate continuous learning beyond the traditional classroom setting. Training requirements for educational technologies are essential to ensure that educators and learners can effectively utilize these tools. Continuous professional development and support are crucial for staying updated with the latest advancements and best practices in educational technology. Various solutions developed by C-DAC in this area are as below.

eLearning System and Solutions

Olabs NextG: Next Generation Online Labs (OLabs) for schools

OLabs NextG: Next Generation Online Labs (OLabs) is an initiative aimed at designing and developing 500 online labs for school students in classes VI-XII, covering various subjects. The goal is to expand the reach and enrich the lab experience for more students, enhancing their understanding of related concepts.

The project is funded by the Ministry of Electronics and Information Technology (MeitY) and the Ministry of Education (MoE). Current achievements include the development of 100 new labs in various subjects for classes VI-XII, the integration of 212 online labs on the Diksha platform, and training of over 900 teachers via online mode. Two AR labs and one VR lab for social science subjects have been developed, and OLabs mobile app (version 3) is hosted on the Mobile Seva app store. Translations of 5 mathematics and 5 social science labs into Hindi have been completed, and Google Analytics 4 has been integrated into newly developed labs to measure engagement. The OLabs Android app has 6,407 downloads on the mSeva App store, and the offline version is being deployed in 131 schools in Rajasthan, and POC of deployment of Olabs on the smartboards of 5 ERMS schools provided by ERNET.

GLAMS: Gamified Learning Assessment Management System

Gamified Learning Assessment Management System (GLAMS), revolutionizes education through its engaging and flexible platform. Catering to diverse subjects, it blends strategic gameplay with powerful analytics, ensuring competition, collaboration, and customization. By analyzing candidate patterns, GLAMS enhances skills and offers tailored recommendations. Launched on February 29, 2024, at International Symposium on Security Engineering for Trusted Cyberspace (ISSETC) – 2024, Rajgir, Bihar, the event saw dignitaries from Ministry of Electronics and Information Technology (MeitY) and Bihar Police. Deployment at Army Public School, Danapur, Bihar, highlighted its transformative potential, gathering positive reviews. With its successful pilot, GLAMS emerges as a pivotal tool in reshaping global education.

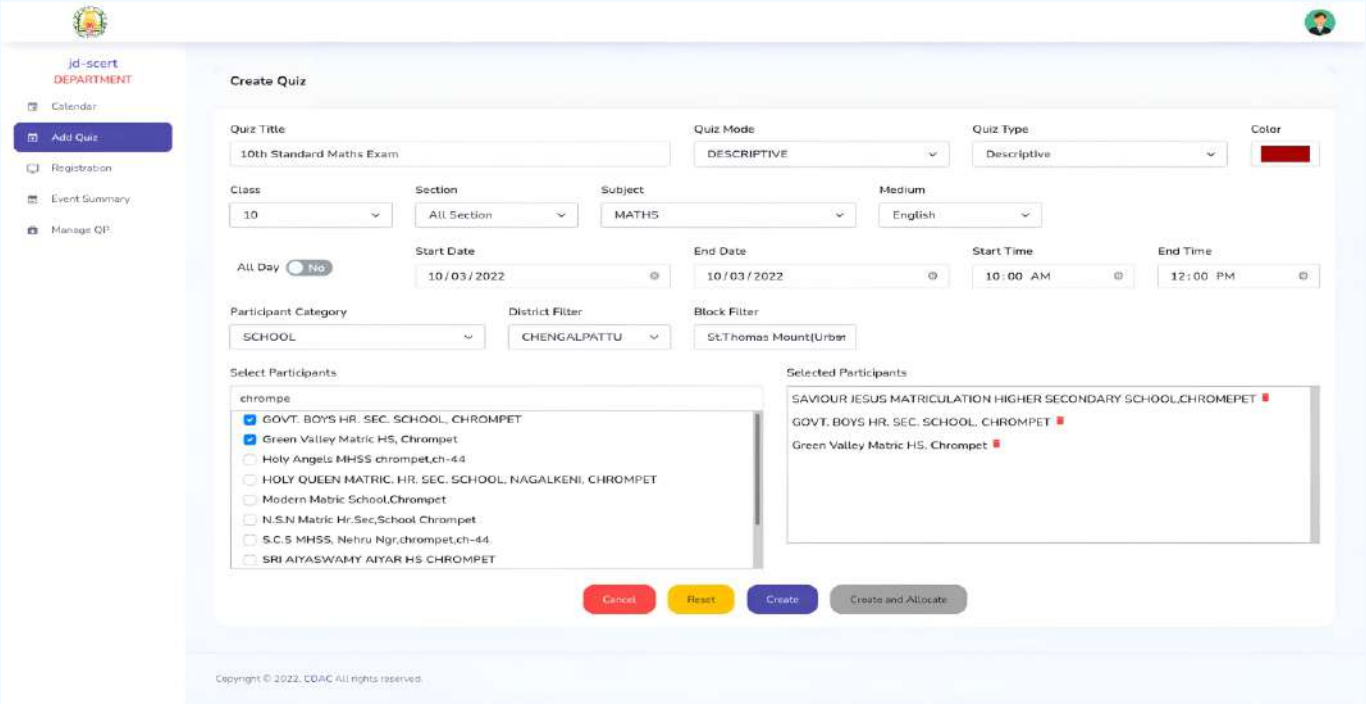
Gamified Learning Assessment Management System (GLAMS)

Set up of Real-Time Cyber Security Scenario-based Self-Paced Learning Training Facility (Cyber GYAN)

The Cyber GYAN project is approved by the Ministry of Electronics and Information Technology (MeitY), Government of India. Project objective is to set up and establish a State-of-art Real Time Cyber Security Scenario based Self-Paced Learning Training Facility (Cyber GYAN) for SC, ST, and Economically Weaker Section students of Under Graduate and Post Graduate courses in Computer Science and Electronics stream of Government Colleges of 8 North-Eastern States and 4 other states namely Uttar Pradesh, Haryana, Gujarat and Kerala of India. Significant achievements in this project include the establishment of a state-of-the-art training facility for self-paced learning. To date, 2000 students have registered for this training, with over 500 students already trained. Additionally, 400 Master trainers have been trained. Furthermore, 90 cybersecurity exercises have been designed, developed, and automated.

BOSS Based Student Assessment Solution

As part of The Samagra Shiksha (Centrally Sponsored scheme in partnership with the State Government of Tamil Nadu) scheme, C-DAC developed and implemented a complete suite of BOSS Based student Assessment solutions for the School Education Department, Tamil Nadu to test the level and learning outcomes of students at all standards. Key features of the product include a question bank creation and curation tool, and an operational scheduling tool for HiTech lab software that allows for the creation, management, and interface of a digital calendar. It also features a centralized exam system management system and an integrated exam management and conduction system. Additionally, it offers a comprehensive operational, management, and analytics dashboard with reporting and alerting modules. The application has an easy-to-use scheduling application where users can schedule an Examination. Teachers can then choose questions from the question bank created by them or by other teachers across all schools based on standard/medium/subject and even the complexities set by the curators.



Event Creation in BOSS Based Student Assessment Solution

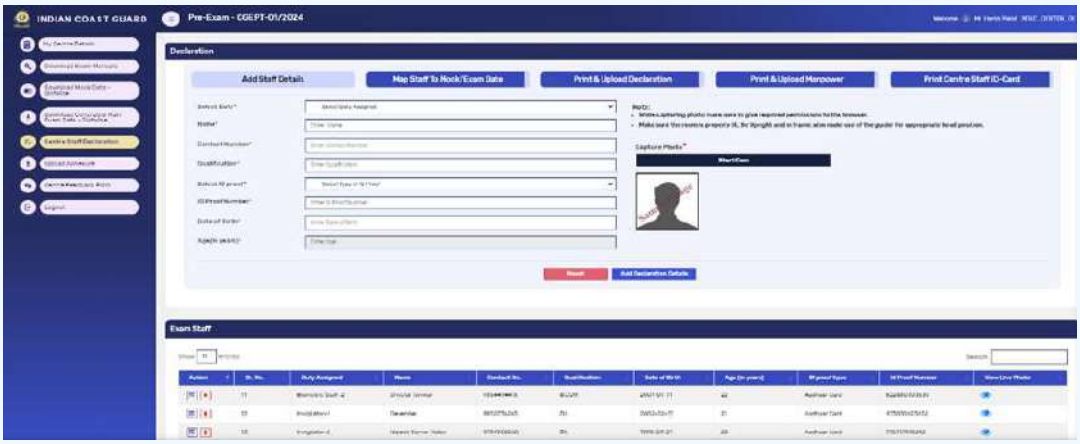
Online Examination Tools and Services

Comprehensive Recruitment System and Exam Conduction for Indian Air Force

Indian Air Force invites Indian citizens (Men and Women) to be part of this elite force as Group 'A' Gazetted Officers in Flying and Ground Duty (Technical and Non-Technical) branches. Under the Agnipath scheme, the recruitment of AgniveerVayu is conducted in IAF. Approximately, 11.87+ lacs candidates have registered for the AFCAT & AgniveerVayu exam in 2023-24.

AFCAT Portal

The portal is launched with the goal of simplifying the registration process, integrating advanced features such as Object Identification, facial recognition, real-time photo capture and matching, to ensure the authenticity of applicants using AI and ML algorithms, bolstering security measures. A Registration portal has been developed for the Recruitment of Outstanding Sportsmen of IAF, under the Agniveervayu sports disciplines.



Agniveervayu Portal

Comprehensive Recruitment System and Exam Conduction for Indian Coast Guard

The Indian Coast Guard (ICG) is a maritime law enforcement and search and rescue agency of India with jurisdiction over its territorial waters including its contiguous zone and exclusive economic zone. C-DAC has designed and developed a web portal for the Recruitment and Selection of Officers (Assistant Commandant) in General Duty, Technical (Engineering & Electrical/Electronics) branch and Sailors (Yantrik / Navik - General Duty & Domestic Branch) in ICG. Approximately, five lacs candidates have registered for the ICG-Officers & Sailors exam in 2023-24.

Indian Coast Guard Portal

Online Examination and Result Processing System

C-DAC has developed an online examination system which is LAN based, question paper based and supports conduct of exam in a secure manner. AES 256-bit encryption is used for encrypting registration data, question paper and Response files. Candidate interface is only accessible on authorized PXE embedded browser. Only non-tampered response files are allowed to get uploaded into Result processing system for result generation. The software includes Question and Option Shuffling, Random seat allocation to candidates, Automatic Time management and various other features to ensure smooth conduct of various recruitment and admission exams. Impact of the software has been Increased Transparency and trust, Reduced recruitment cycle time, Error free evaluation, Easy availability of data for post exam support i.e., for RTI, Court cases etc., Exam even in remote areas, thereby reduced travel time for candidate. The software has been used for conduct of recruitment exams for Indian Air Force, Indian Coast Guard, Indian Navy, Rajasthan Housing Board, ICMR, AIIMS Rajkot, NIOS, Andaman and Nicobar Administration etc. Approx. 10 Lakh+ candidates have successfully appeared for the exams through the software during the 2023-24.

The Process Automation for Competitive Exams (PACE) – For GATE/ JAM

The Process Automation for Competitive Exams (PACE) initiative streamlines various phases of competitive examinations, including candidate registration, application completion, exam center assignment, admit card generation, result processing, scorecard issuance, choice selection, and seat counseling.

GATE and JAM examinations have been successfully managed under this project for the past decade. Additionally, NBE's DNB/FNB seat counseling has been conducted as part of this project since 2018.

In 2023-24, GATE processed registration, admit card generation, and result processing data for 8.5 lakh candidates, while JAM processed registrations, admit cards, result processing, and seat counseling for 79 thousand candidates. During the most recently completed cycle, we successfully conducted seat counseling for 2600 seats for NBE's FNB/PDCET/DNB (POST MBBS).

GATE/JAM examinations conduction has been funded by organizing institutes, 8 IIT (Indian Institutes of Technology) and IISc (Indian Institute of Science), Bangalore. DNB/FNB Seat Counseling activity has been funded by NBE (Nation Board of Examination), Delhi.

Question Bank Management & Question Paper Set Generator System

In the dynamic landscape of computer-based tests, the need for a robust and efficient question bank system is paramount. The Comprehensive Question Bank and Question Paper Generator System is a cutting-edge solution designed to streamline and enhance the question paper generation process. This system is crafted to cater to the diverse needs of Computer Based Tests (CBTs) by providing a centralized repository of high-quality questions spanning various topics and difficulty levels. The question bank system also facilitates the generation of question paper sets according to specified blueprints, incorporating quotas based on subject, topic, and difficulty levels, while seamlessly incorporating randomization. The solution is currently used by the Directorate of Manpower Planning and Recruitment – Indian Navy (DMPR-IN) – IHQ-MoD (Navy), New Delhi, and C-DAC Chennai for recruitment exams – computer-based tests.

CADET – C-DAC Adaptable Recruitment Portal – Recruitment Application as a Service

The e-Recruitment Portal is offered as a service for advertising vacancies directly by organizations and managing the potential applications received through the portal. It has features such as easily configurable and customizable by organizations, password less login for candidates, a dashboard for HRD to manage their recruitments, a plug-and-play Payment Gateway, and extension of advertisement for selected posts. It is offered as a Service to C-MET and C-DAC, and discussions are in progress to offer it to AIIMS.

Cyber Security and Cyber Forensics

C-DAC has made its mark as a trusted Cyber Security products & services provider, in the government sector. Every aspect of Cyber Security including Application security, Cloud security, Critical infrastructure security, Data security, Endpoint security, IoT (Internet of Things) security, Mobile security, Network security and Cyber Forensics has been addressed by C-DAC. As a CERT-IN empaneled agency, C-DAC has been actively contributing to various audit and assessment efforts. C-DAC is in the constant process of evolving new technology, products and services and enhancing its existing products & services using Artificial Intelligence and Machine Learning to address the constantly evolving cyber security requirements of the nation. Various solutions developed by C-DAC in this area are as below.

Cyber Threat Intelligence, Monitoring and Mitigation

A suite of products has been developed by C-DAC in this area to help monitor and mitigate Cyber Threats.

C-DAC Security Information and Event Management (CDACSIEM)

CDACSIEM is a comprehensive security solution having a data aggregator which gathers immense amounts of log data from the entire networked environment, normalizes and applies analytics, as well as provides complete visibility of security to the SOC analyst. It is a centralized solution that enables detection and allows for investigation while providing insight visibility. CDACSIEM aggregates, normalizes, stores, and applies analytics to the data to detect threats and generate alerts for remediation.

Latest features of CDACSIEM v4.0 include Log Collection, Real time Monitoring, Threat Intelligence (30+ Threat Feeds), User Entity and Behaviour Analytics (UEBA), Correlation Engine, Compliance Reports (NIST, PCI-DSS & HIPPA), Alerting Mechanism, Dashboard & Visualization, Log Forensics, Log Retention & Archiving, Vulnerability Management, Asset Discovery & Management, Ticket Management System.

CDACSIEM has been successfully deployed at various organisations including C-DAC Noida Data Centre, Mormugao Port Trust, Goa, India Trade Promotion Organization (ITPO), Delhi, Project 22, MHA Agency, Delhi.

Rakshak DNS

Rakshak DNS is a solution designed to protect enterprise information and infrastructure from the DNS perspective. It is a safe, secure, protective DNS resolver with capabilities for detecting and filtering malicious domains and preventing cyber-attacks such as phishing, pharming, malware download, botnets and other similar attacks. Rakshak DNS, the global open, public resolver is implemented and live through the IP addresses IPv4: 103.58.120.120 and IPv6: 2405:8a00:8001::20

Cyber Threat Management System (CTMS)

CTMS is an integrated framework for monitoring, analyzing and enabling mitigation of cyber threats. The framework is based on client server architecture where client nodes running a variety of honeypot sensors emulating the organisational attack surface, captures cyber-attacks targeting the organisations. The captured attacks are pushed to a central collection server where the data is further analysed for threat prediction and mitigation. Deployed in various critical infrastructures including State Data Centers, PSUs, Banks.

Cyber Threat Management System (CTMS) Dashboard

Vulnerability Scanner

The scanner performs a passive web security scan to discover common web application vulnerabilities and server configuration issues. The overall goal is to help secure web applications by identifying and mitigating any web application vulnerabilities.

Vulnerability Scanner

This has been deployed at Punjab University, Chandigarh, Punjab National Bank, Delhi and C-DAC Mohali, Hyderabad, Pune, Chennai, Trivandrum, Mumbai, Noida & Bangalore centres.

SDN based Proactive solution for Cyber Attack Mitigation

This is an SDN enabled proactive security solution for detection and mitigation of targeted cyber-attacks by dynamic security policy generation based upon the observed cyber threats and on the fly network restructuring to quarantine and mitigate the detected threats. This framework not only mitigate the observed cyber threat but also captures information regarding motives, objectives of the attacker for better response and adds sufficient entropy in the system to discourage any future attempt by attacker to breach the system. The developed framework designed to be low cost, scalable, easy-to-use and a comprehensive solution, ideal for deployments in enterprise networks.

FakeCheck (Deepfake Detection System)

C-DAC has developed FakeCheck, a tool for deepfake detection, focusing on both low and high quality manipulated media and has been deployed at Central Forensics Science Laboratory (CFSL) Kolkata and CID Kolkata for evaluation. Detection and mitigation of deepfake content is of utmost importance to combat the spread of misinformation and safeguard the integrity of media.

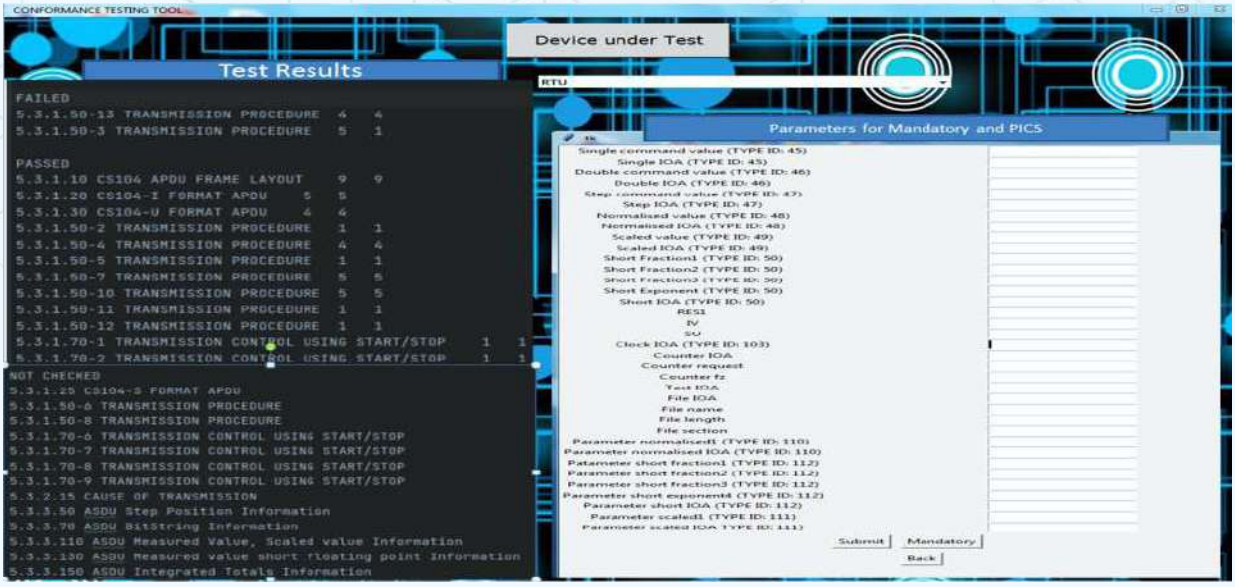
Data Science Framework for Fraud Detection in ATM Transactions in Banks

ATM Fraud Detection (AFD) Framework is a real-time intelligent AutoML solution that combats sophisticated fraud with actionable insights. It is a no-black-box solution that allows users to choose algorithms and/or methods at every stage of data analytics and Machine Learning Life Cycle of fraud detection. It also provides a dashboard for providing visual insights of legitimate and fraudulent ATM transactions. Major Outcome of this project is a prototype for ATM Fraud Detection framework to find out the fraudulent ATM transactions in near-real-time and visual analysis and the same has been deployed at IDRBT Hyderabad.

Enterprise Security IT / OT

SCADA communication protocol conformance testing tool

Conformance testing plays a critical role in guaranteeing interoperability and security within Power Supervisory Control and Data Acquisition (SCADA) systems. C-DAC has developed a tool for dedicated conformance testing for the IEC 60870-5-104 communication protocol, widely used in the power industry. By leveraging this tool, developers and users can verify that their IEC 60870-5-104 implementations strictly adhere to the standard, minimizing the risk of compatibility issues during system integration. The testing methodology aligns with the IEC 60870-5-604 standard, ensuring a comprehensive evaluation of the protocol's functionality and conformance. The developed tool includes components for test case generation, execution, and result analysis.



SCADA communication protocol conformance testing tool

Mobile Security

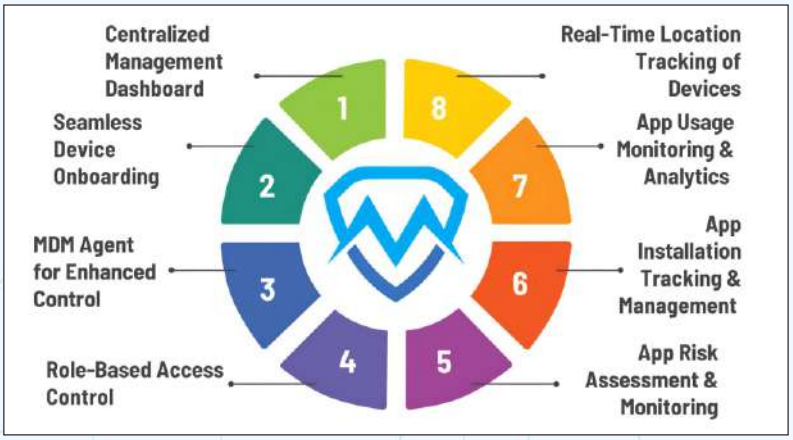
A large number of solutions have been developed for Mobile Security ranging from authenticating apps to mobile device management to mobile security.

Praamaanik

This is a software solution, leverages Blockchain technology to register mobile app fingerprint on an immutable ledger. This facilitates verification of the mobile app origin and helps citizens to invoke the authentic apps while shielding them from untrusted faux apps. This has been deployed across Geographically Distributed Blockchain Infrastructure.

M-Prabandh

M-Prabandh is a Mobile Device Management (MDM) solution that allows organizations to effectively monitor & manage mobile devices and reduce the risk of data breaches & theft, is essential for securing organizational data in today's mobile-driven business landscape. It also aids in safeguarding business critical information and uphold data security standards. The centralized management dashboard allows organizations to take control of the mobile devices effortlessly and provide a comprehensive interface, seamlessly presenting information about all connected devices.

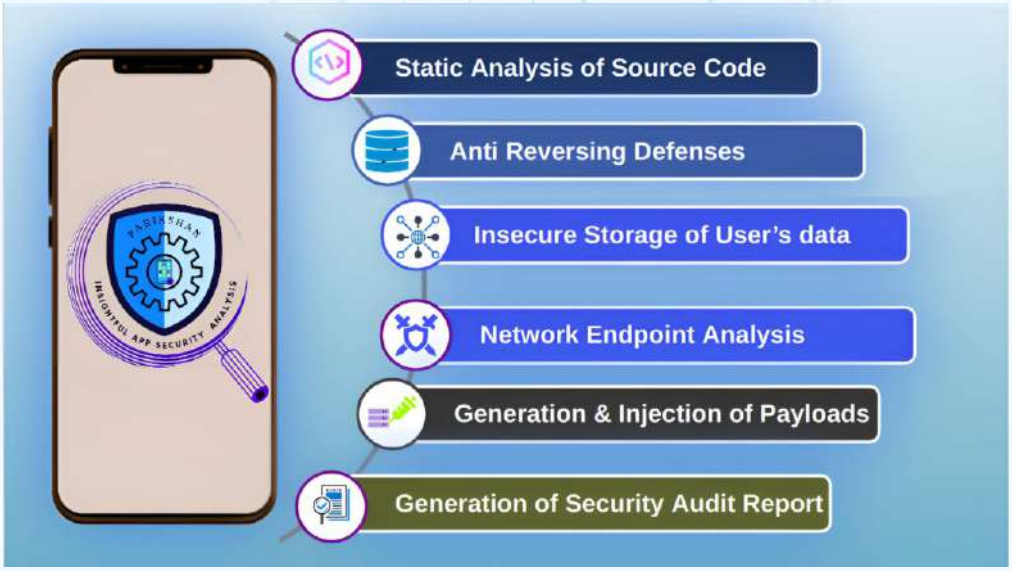


Features of Mobile Device Management (MDM) solution

M-Prabandh Mobile Device Management Solution was launched on February 14, 2024 as part of foundation day celebrations of C-DAC Hyderabad

Parikshan

Parikshan is an Automation tool for performing static and dynamic analysis of mobile applications. The tool has the capabilities to identify security vulnerabilities and perform penetration testing for a few of them. As an outcome, a detailed security audit report is generated containing the information about the identified vulnerabilities which helps the Security Analysts to carry out further analysis.



Features of Parikshan

Parikshan was launched by Shri S. Krishnan, IAS, Secretary, MeitY, Government of India on February 2, 2024 at C-DAC Hyderabad.

Critical Infrastructure Setup

C-DAC has successfully completed setting up of a National Security Operation Centre at CERT-In in December 2023 as a part of Setting up of The National Cyber Coordination Centre programme.

Advanced Cyber Forensics

C-DAC has also been providing cyber forensic services to various Law enforcement agencies in very crucial and critical cases of the nation.

StegScan V2.0

StegScan V2.0 is a Digital forensic analytical tool which searches for artefacts in the Microsoft windows registry or in the file system based on user choice and can handle 10,000+ signatures (includes Steganography, Cryptography & Digital Watermarking Tools). The product has been deployed at MHA agencies, NEPA and State Police offices.

Digital Trust and Privacy

ANETRA SDK

ANETRA SDK is a software solution supporting REpresentational State Transfer (REST) Application Programing Interface (API) which provides features such as video-based person identification & authentication for remote monitoring activities including work from home, study from home, online proctoring and so on. Key Features include SDK support for Web Server based APIs for Person Enrolment, Person Detection, Face Matching, Liveness Detection, Pose Detection, Gender Detection, Face Verification, Object Detection, Update User details, Token Generation and Authentication. The SDK is available as Docker GNU/Linux containers with Pre-installed REST APIs, REST APIs for installation in Native GNU/Linux environment.

Building Trust on Computing Platform and training of Secure Coding of security chips

TrusToken – DSC (Digital Signing Certificate) Token Hardware, a plug-and-play USB multifactor authentication device helps to enhance digital security and ensure/establish the identity of a user. Secure Dongles are physical devices used to gain access to an electronically restricted resource or to provide additional features to any existing system. It can be used to prove ones identity electronically. The dongle may act like an electronic key to access secure contents. The TrusToken enables PKI-based operations, with the additional support of ECC. TrusToken works and relay on indigenously developed and home-grown Operating System based on the Indian Standards – IS 19790 Part 1 & 2. The Developed USB Token Hardware is based on Secure SoC (System on Chip) with EAL5+ certified chipset, supports inbuilt True Random Number Generator (TRNG), PKI Algorithm such as RSA & ECC Support, and uses FIPS Certified Crypto Library.

USB Token - TrusToken

Network Security

InTrust

InTrust is an indigenous asset, traffic and automatic vulnerability assessment system for Zero Trust Network. InTrust can cater to all enterprise and e-governance networks where security and transparency of the assets are critical to the organization such as Defence, LEA, Government etc.

It provides detailed information about the devices, their communication with other devices/ applications and vulnerabilities in the system connected to the organization network. InTrust automatically keeps track of the list of assets, operating system, services and brings out the security posture. Based on the data collected from the host and network, InTrust analyses, detects and notifies the attacks and anomalies targeting the network. It can also detect and track the activities from new and rogue devices that are connected to the network. Communication from a host to a blacklisted IP, URL and anonymous IPs are also detected and notified by InTrust.

InTrust

The system has been deployed in Centre for Development of Telematics (C-DoT), Bangalore and C-DAC Bangalore.

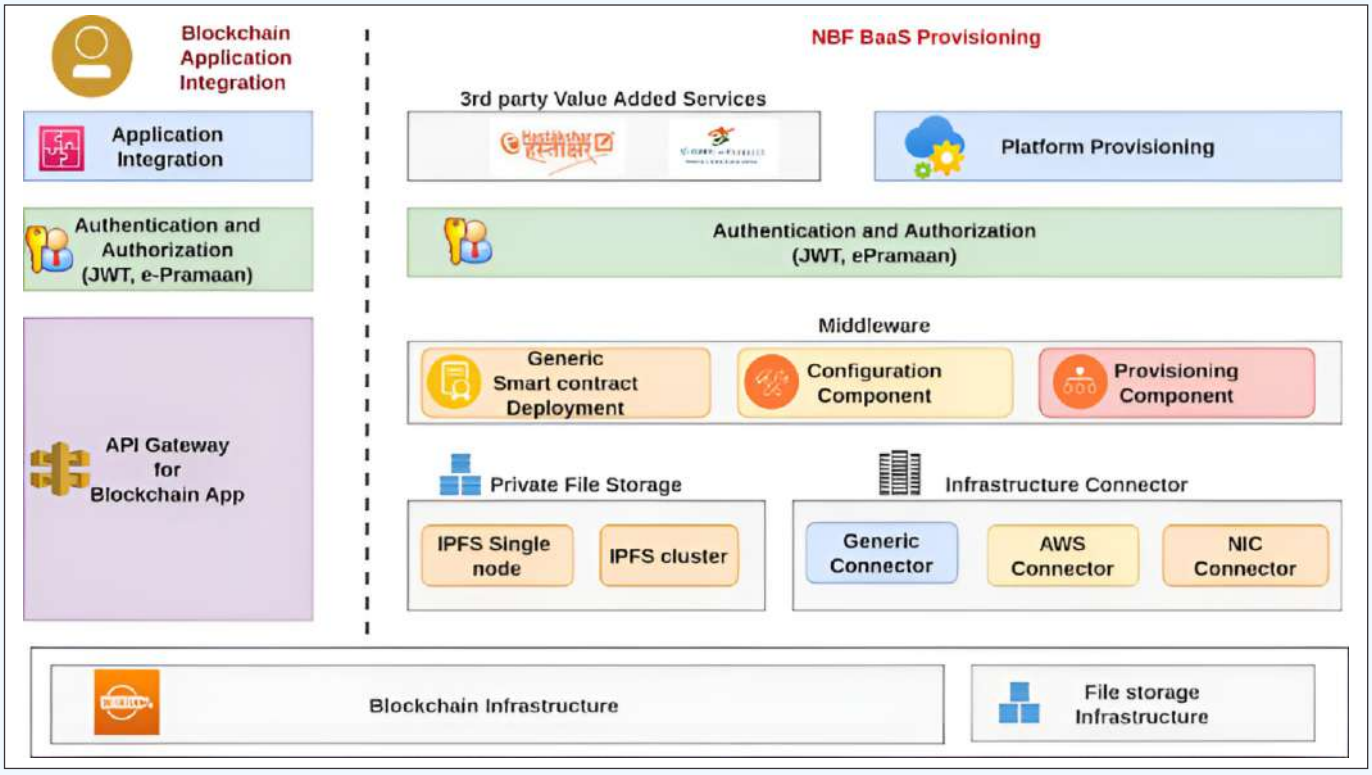
Darpan series of Network Management System (NMS) and Orchestration tools

C-DAC's Darpan NMS has been deployed in State Data Centres, State Wide Area Networks, Mission Critical Networks of the nation. Recently added to the portfolio of Network Management is the DARPAN Virtual Network Solution which combines network edge platforms for Virtual Network Functions (VNFs) and SDWAN capability. A ticketing system and helpdesk solution, Saran helps the ticketing, management & administration of these solutions.

Blockchain Technologies

National Blockchain Framework (NBF)

Blockchain as a Service has been deployed across NIC Data Centres in the country. The Technology Stack has been designed and developed for deployment with several components such as dashboard for automated network setup, generic smart contract layer (templates and design patterns), authentication and authorization functions, certifying authority and enabling the same through Open APIs. The technology stack of NBF has Smart Contract Library for different application domains such as Supply chain, Medical Insurance, Asset Management and Drug Track & Trace. Security vulnerability assessment test suites for auditing smart contracts is included.



National Blockchain Framework (NBF)

Cryptography

A gamut of products has been developed in Cryptography.

GANGA

GANGA is an indigenously designed and developed, Non-Reproducible Cryptographically Secure pseudo random number generator, aimed for use in strategic applications.

It was launched on February 29, 2024, at the International Symposium on Security Engineering for Trusted Cyberspace (ISSETC) – 2024, in Rajgir, Bihar, in the presence of officials from MeitY and Government of Bihar.

StegoCheck

StegoCheck is a Signature based steganalysis software package which caters to the needs of the LEAs of India. Its features are comparable to International Products of repute. The product has been deployed at MHA agencies, NEPA and State Police offices.

Services

Managed Security Services (Security Operations Centre)

C-DAC has undertaken Managed security services for Government organisations which includes 24x7 security monitoring, Incident response, cyber security advisory services for various clients including Jawaharlal Nehru Port Authority, Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Limited, Managed Security Services for Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited.

Security Audit Services

Cyber Security Services offered by C-DAC include Vulnerability Analysis and Penetration Testing, Infrastructure audit, SOC audit, IT Control review, Application Software Audit, Network security and Information System Audit. Carried out Security Audit of e-Commerce Portal/ Websites for various Government organisations. C-DAC is a CERT-IN empaneled agency for Security Audit.

C-DAC has undertaken Cyber Security Audit for various organisations including Election Commission of India, Kerala Bank, MizoMart e-Commerce Portal, Establishment of Cyber Forensic & Device Security Certification Laboratory for Government of West Bengal; C-DAC has also undertaken Information Security Audit for Banks & Financial institutions including SIDBI, IBBI Compliance Audit, VAPT for Manipur State Power Distribution Company Limited Website, for IIT Guwahati website, Assam Food and Civil Supplies Corporation, Guwahati website and G.C College, Silchar Assam.

Automotive Technology

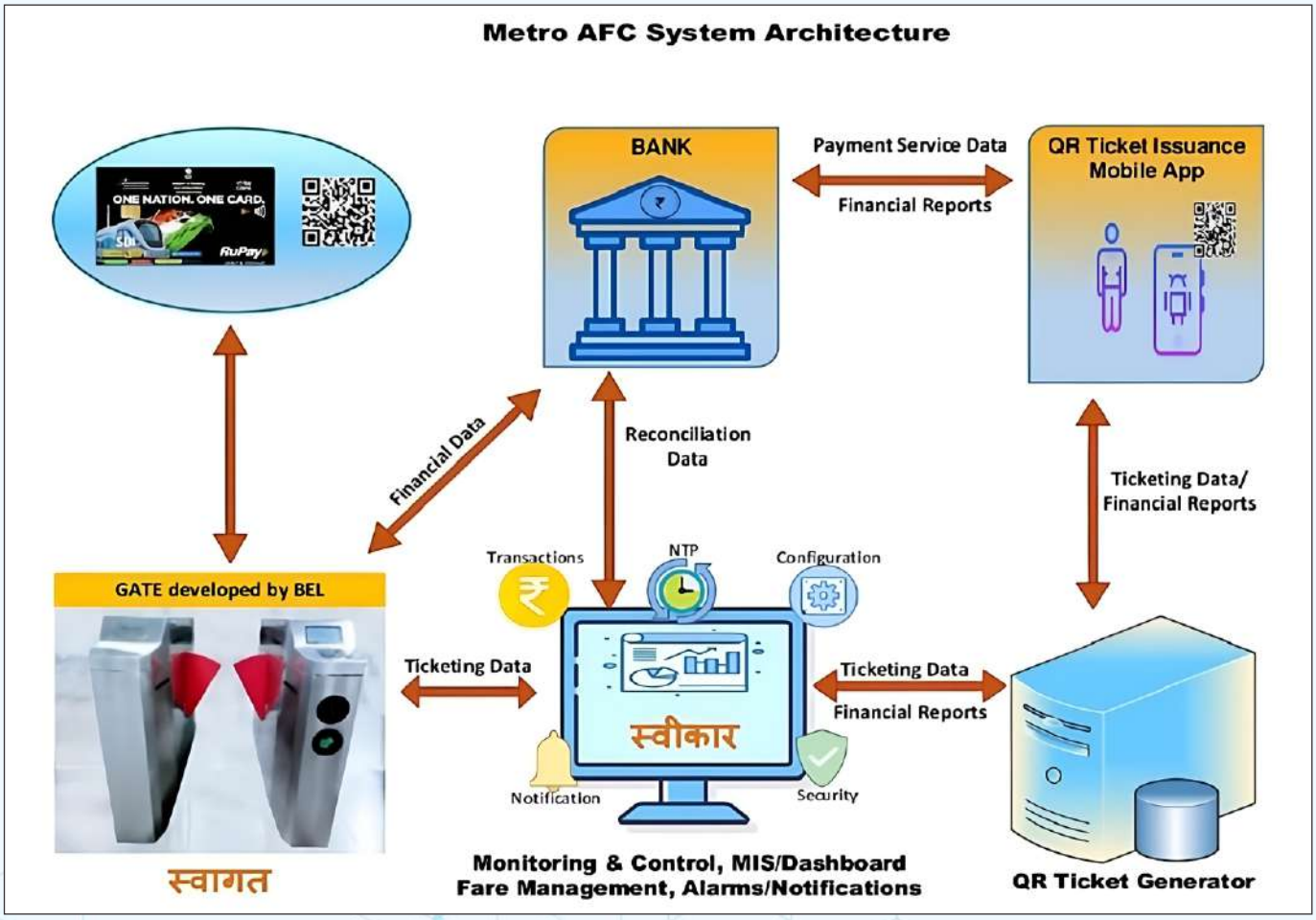
C-DAC is actively involved in advancing automotive technologies, focusing on areas such as autonomous robots and smart transportation systems. The work includes solutions for Public Transport, Road safety, Smart sensors, etc. Various solutions developed by C-DAC in this area are as below.

Public Transit Solutions for Smart Mobility

NCMC and QR Compliant Automatic Fare Collection (AFC) System for Metro Operators

C-DAC's AFC solutions are Vendor and Bank Agnostic Solutions, designed specifically for Indian conditions where heavy footfall are the norms. It is the State of the Art, Scalable, Modular, Highly Secure, National Common Mobility Card (NCMC) and QR Compliant AFC System with deployment at customer premises. It can be quickly customized as per the requirements of the metro operator. AFC System supports multiple ticketing options like NCMC card and QR coded tickets. Single or multiple journey QR coded tickets for an individual or a group may be purchased through our Mobile App "Travel Mozo". For people not using smart phones, Single Journey Paper QR Ticket for same day can be purchased through Ticket office machine (TOM) at the ticket counter/customer care.

C-DAC offers complete solution and lifecycle support to Metro Operators from Rollout to Operation and Maintenance, thus offering complete peace of mind to metro operators. Use cases of the AFC System includes Automatic Fare Collection System for Metro Operators and for Transit Operators with closed premises. The system is deployed on two stations on two gates at Namma Metro, Bangalore.

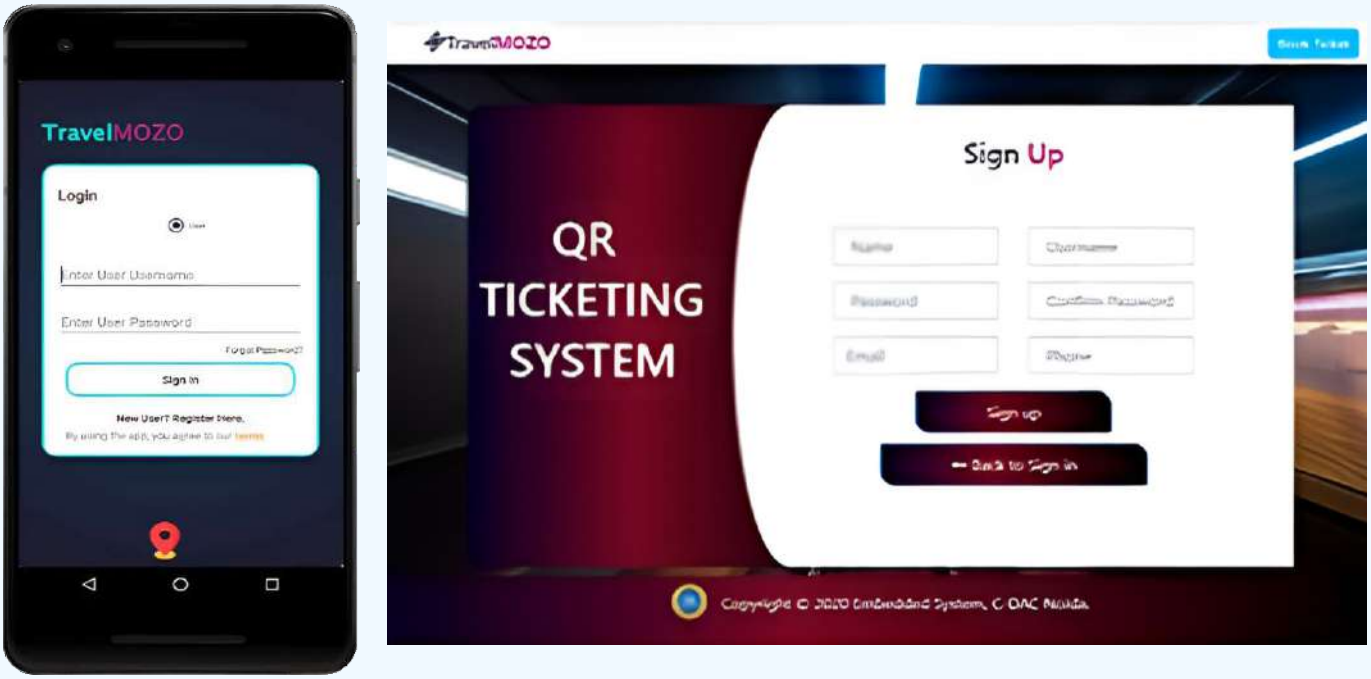


Metro AFC System Architecture

QR Ticketing System for Transit (Bus & Metro) Operators

Aligned with the Government of India's Smart Cities Mission, the QR Ticketing System is a completely indigenous solution and addresses, three very pertinent requirements for transit operators which includes a) Enabling cashless Initiatives, b) Reducing rush hour queues and c) Cost cutting by replacing tokens in Metro rails and paper tickets in Buses.

QR Ticketing offers facility of single or multiple journey, QR coded tickets for an individual or group. QR Tickets may be purchased through Mobile App or Web App. It is a fully Integrated Ticketing System with Ticket Generator, Mobile & Web App with Payment Gateway integration, Public Transport Operators' (PTO's) Automatic Fare Collection (AFC) Integration, QR scanning & Validation terminal software. QR Ticketing System is deployed on two stations at Namma Metro, Bangalore and deployment is in progress at Chennai Metro rail Limited (CMRL), Chennai.



QR Ticketing System

Payment APIs for NCMC based Parking Solution for Metro Stations

The key advantage of this solution is seamless integration of NCMC cards without requiring significant modifications to PTO's existing Parking/Ticketing App and Backend System. This solution ensures a smooth transition to leverage the benefits of NCMC for Parking/Ticketing systems. The public use single NCMC card for all transactions, including parking, ATM, and multi-modal travel. This is a significant turning point in the direction of "One Nation, One Card." The system is deployed at Chennai Metro Rail Ltd. (CMRL), Chennai.

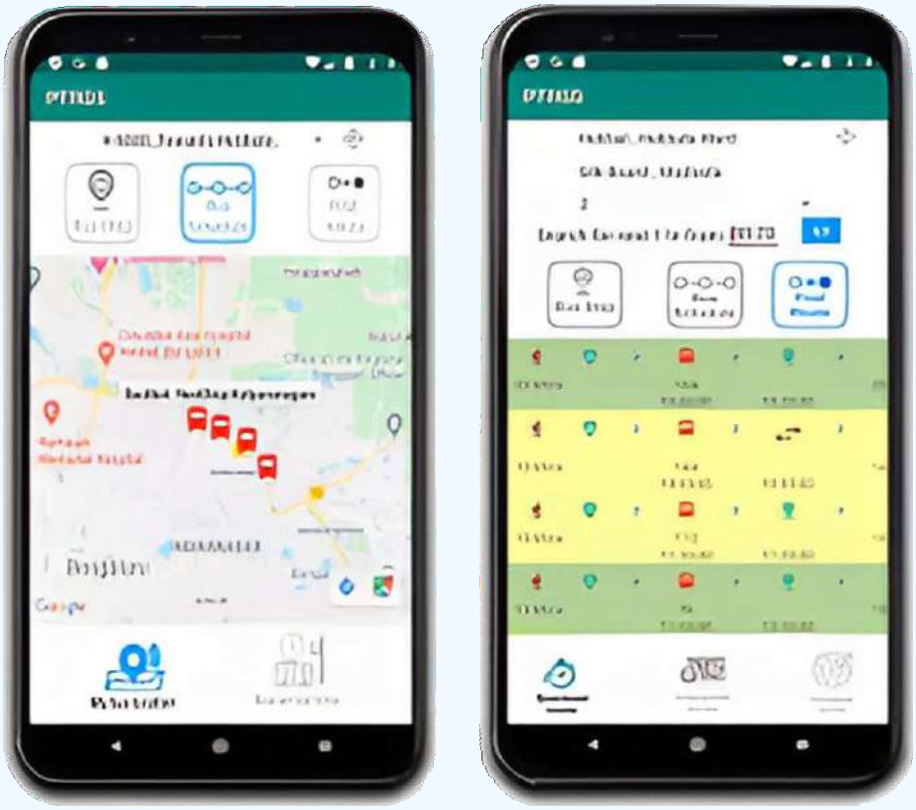
Vehicle Tracking and Fleet Management System (FlexiFleet)

The Fleet Management System for live tracking and flexible operations offers comprehensive features to effectively manage and streamline fleet operations 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, push notification, route design, route planning and optimization, scheduling, crew management, trip management, alert management, expense tracking, and driver score reports, etc. for overall fleet management. It features a decision summary dashboard and

analysis based on trips, alerts, route schedules, deviations, and expenses, along with mobile apps for Android and iOS, and APIs for integration with third-party solutions. Four industries have signed the Reseller Partnership agreement with C-DAC to market, sell and support FlexiFleet.

Personalized Transit Route Guidance System (PTRGS)

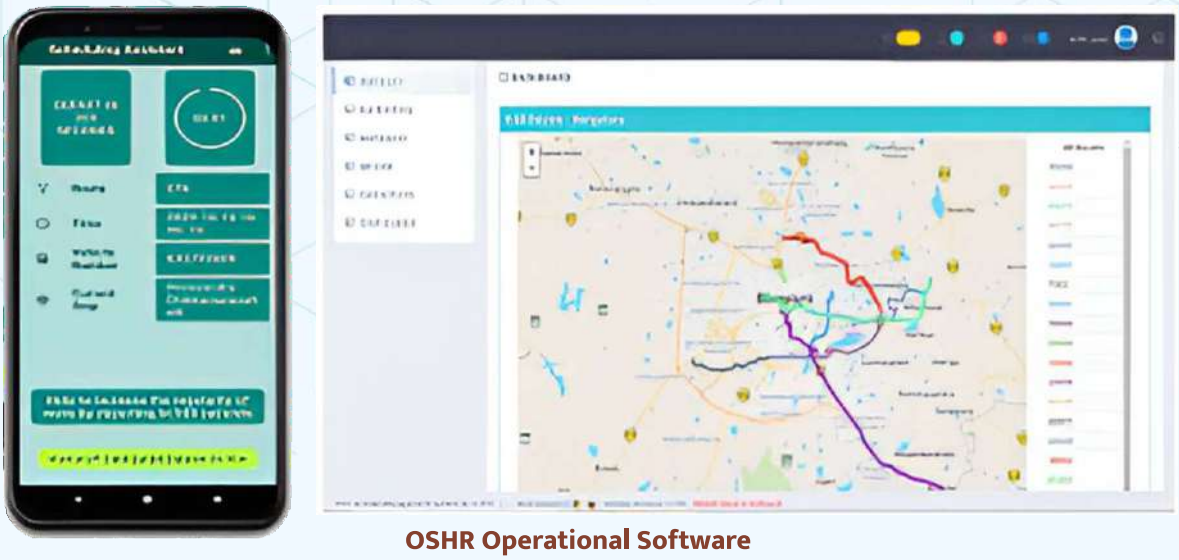
The Personalized Transit Route Guidance System (PTRGS) is a mobile application that provides passengers with optimal routes with due consideration of reliability and user preferences. The application combines static and real-time information on the buses, schedules, passenger demand and transit network with state-of-the-art data-driven models and algorithm to provide better routes to passengers. The development was jointly undertaken by IIT Madras and C-DAC. Testing of PTRGS mobile app carried out using live data from the Metropolitan Transport Corporation (MTC) buses, Chennai. Four industries have signed the Reseller Partnership agreement with C-DAC to market, sell and support PTRGS.



The Personalized Transit Route Guidance System (PTRGS) mobile app

Operational Strategy to improve Headway Reliability of public transport buses (OSHR)

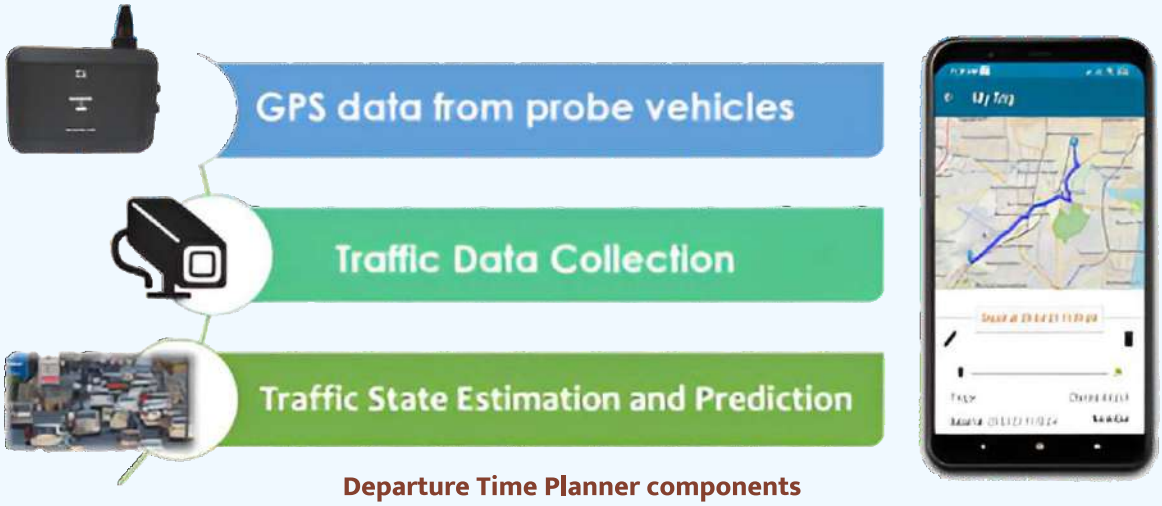
OSHR is an operational software aiding to reduce bus bunching on a specific route that the public transport buses are scheduled. The system provides an operational strategy for systematic delaying of in-services buses on a route to reduce bus bunching. The system uses real-time information for evaluating headways and estimates headways for holding buses at designated stops to maintain optimum headway between the in-service buses on a route. The development was jointly undertaken by IISc Bangalore and C-DAC. Prototype testing carried out on one route in Bangalore using a mobile phone application. Four industries have signed the Reseller Partnership agreement with C-DAC to market, sell and support OSHR.



OSHR Operational Software

Departure Time Planner

Departure Time Planner (DTP) is a mobile app-based traveler information system developed by IIT Madras and C-DAC. It provides travel advisory information for public and transport agencies on the optimal departure time from a given origin to reach a selected destination at a desired arrival time, using real-time traffic data from integrated WiFi-DSRC devices to estimate and predict road traffic conditions. DSRC and WiFi-based field sensors were deployed in three Chennai corridors (originating from Vadapalani, T-Nagar, and Tambaram) leading to the airport. The app also gathers GPS data from public transport buses in collaboration with MTC, Chennai. This project was funded by the Ministry of Information Technology (MeitY).



Departure Time Planner components

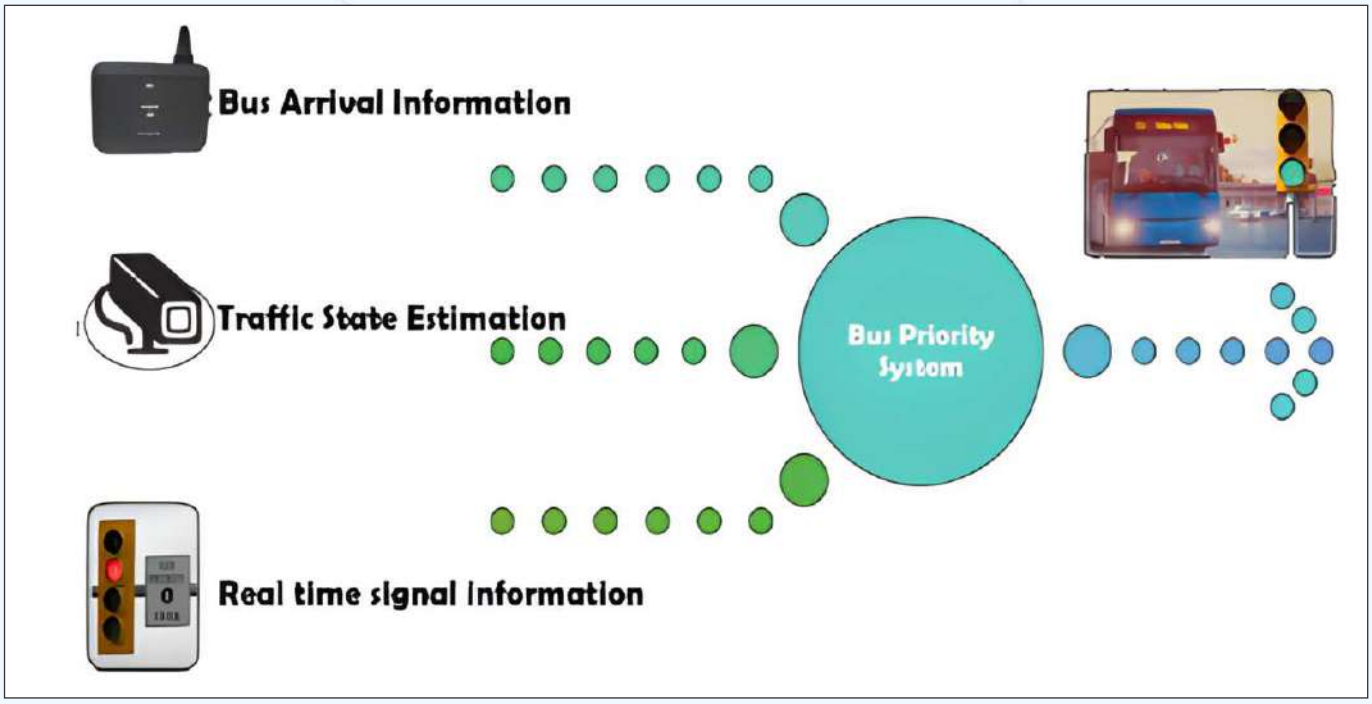
Common SMART IOT Connectiv (CoSMiC) – oneM2M Common Service Platform

Common SMart IoT Connectiv (CoSMiC) is a oneM2M-based middleware software, which provides a framework for data sharing between IoT field devices and applications across different verticals hosted in the Integrated Command and Control Center (ICCC) of smart cities. It ensures interoperability, security, data sharing, and privacy between IoT/M2M ecosystems. The oneM2M platform was hosted on C-DAC's private cloud and tested using data from the Adaptive Traffic Control System installed at Hubli-Dharwad. Key outcomes include the development of the CoSMiC software platform, the Retrofit Adaptor for C-DAC Traffic Controller (ReACT), and the oneM2M-based Traffic Monitoring and Management Software (TraMM-M2M). It was funded by the Ministry of Information Technology (MeitY).

Vehicle Priority & Road Safety Solutions

Bus Priority System at Signalized Intersection

C-DAC along with IIT Madras has developed the system & it is integrated with the C-DAC Traffic Signal Controller. The system facilitates the movement of in-service buses through signalized intersections by minimizing person delay through green extension or red truncation, considering all vehicles approaching the intersection. DSRC and WiFi-based field sensors were deployed at the Tidel Park intersection in Chennai to collect 1-second bus position and traffic estimation data. The BPS algorithm was tested and validated using this data on the VISSIM Traffic Simulator platform for an isolated intersection and was successfully integrated and tested with the C-DAC Traffic Controller. It was funded by the Ministry of Information Technology (MeitY).



Bus Priority System at Signalized Intersection

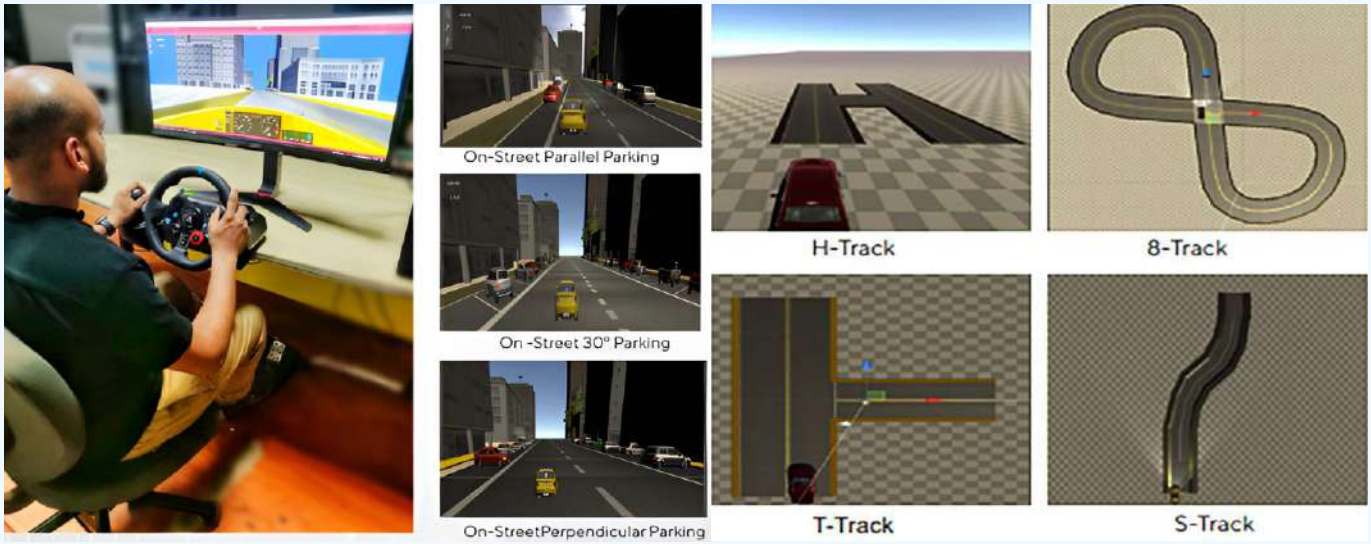
On-board Driver Assistance and Warning System (ODAWS)

ODAWS incorporates vehicle-borne sensors for monitoring driver propensity and vehicle surroundings to deliver audible and visual alerts for driver assistance and warning. It combines mmWave radar, a navigational unit, and a driver assistance console. The mmWave radar provides positional and dynamic characteristics of surrounding vehicles, while the navigational sensor offers precise geo-spatial orientation of the vehicle and trends in driving behavior. The ODAWS software interprets sensor data and delivers real-time safety alerts to the Driver Assist Console. Pre and post-ODAWS test runs were conducted in Chennai and Trivandrum and data collected to model and grade driver behavior. Major outcomes include realization of the ODAWS system with hardware, software, and algorithms (including mmWave radar, navigational sensor IMU + GPS, and ODAWS software), an automotive mmWave radar (77 GHz), ODAWS software, and a navigational sensor (Inertial Measurement Unit with GPS. This product was developed by C-DAC in collaboration with IIT Madras as a part of the InTranSE-II mission of the Ministry of Electronics & Information Technology, Government of India.

Onboard Driver Assistance and Warning System (ODAWS)

Desktop based Driving Simulator for Non-Lane Based Mixed Traffic System

This driver-centric desktop driving simulation software, integrated with a general-purpose traffic simulator, accurately represents Non-Lane Based mixed traffic systems. The product was developed jointly by IIT Bombay and C-DAC. It serves as an effective tool for driver safety training, evaluation, and licensing under heterogeneous traffic conditions. The software features a user-interactive application designed for driver training, offering multiple scenes, diverse road infrastructure, and various types of roads. It integrates both non-lane and lane-based roads and allows the selection of different vehicles, such as cars and trucks. The simulation encompasses various traffic conditions, including urban, rural, and dense traffic scenarios. It includes specific driver license test scenarios and provides scores for different driving tests, culminating in a comprehensive driving evaluation report for the Licensing Authority. The products realized include desktop simulation software integrated with a traffic simulator capable of generating Indian traffic scenarios, packaged as Lite, Standard, Advanced, and Premium versions to target different market segments. It was funded by the Ministry of Information Technology (MeitY).



Desktop based Driving Simulator for Non-Lane Based Mixed Traffic System

5G C-V2X Platform for On-Road Vehicles (PROVE)

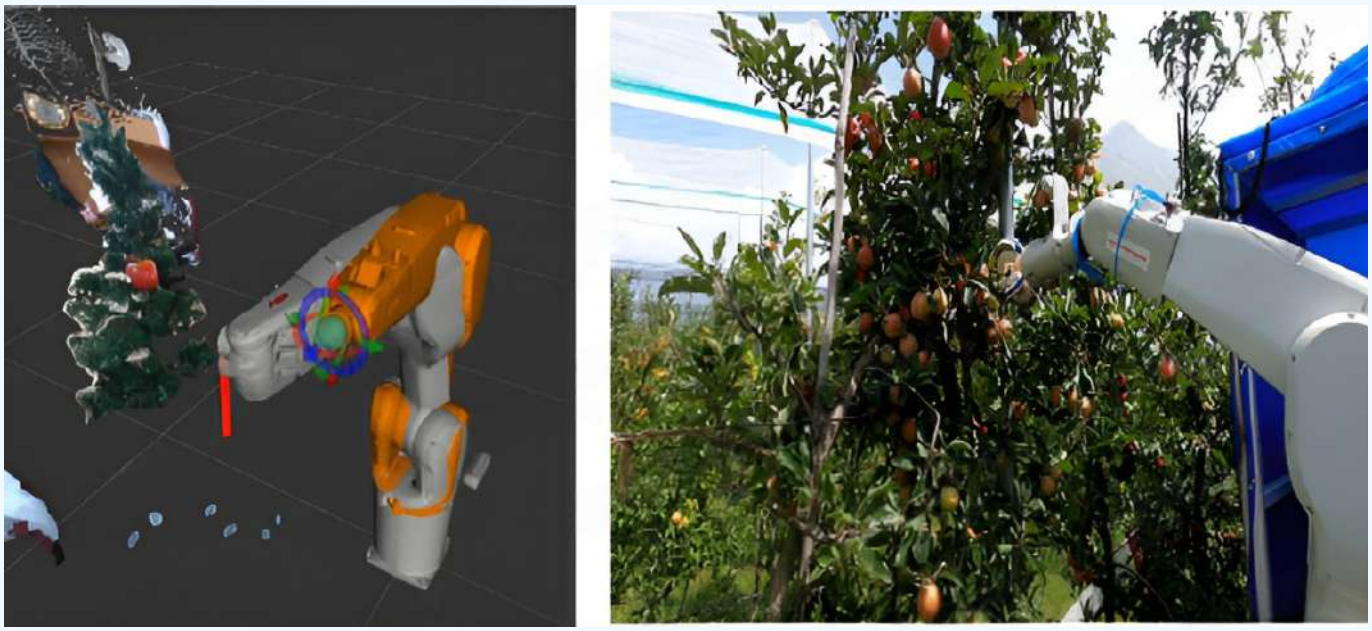
C-DAC has developed indigenous solutions for enabling the C-V2X ecosystem funded by the Technology Innovation Hub on Autonomous Navigation and Data Acquisition Systems (TiHAN) at IIT Hyderabad under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS), Department of Science and Technology (DST), Government of India. C-V2X, defined by the 3GPP standard in Release 14, is state-of-the-art technology enabling Intelligent Transportation Systems (ITS) to provide a safer traveling experience on our roads. V2X offers low-latency Vehicle-to-Vehicle (V2V), Vehicle-to-Roadside Infrastructure (V2I), and Vehicle-to-Pedestrian (V2P) communications, adding a new dimension to future driver assistance systems. The developed C-V2X products comprise On-Board Units (OBU) for

vehicles and Roadside Units (RSU) for road infrastructures to inform vehicles about traffic conditions, road infrastructure, or safety-relevant conditions. The major outcomes of this project include the design and development of a vehicular communication platform with indigenous hardware demonstrating DSRC and C-V2X technologies for OBUs and RSUs, and a software SDK with a vehicular communication DSRC stack featuring IEEE 1609.x and SAE J2735 message formats. Additionally, it includes the performance evaluation of vehicular communication technologies and a comparison between DSRC and C-V2X radios in outdoor vehicular environments.

Autonomous Robots for Agriculture

Vision guided AI enabled robotic Apple harvester

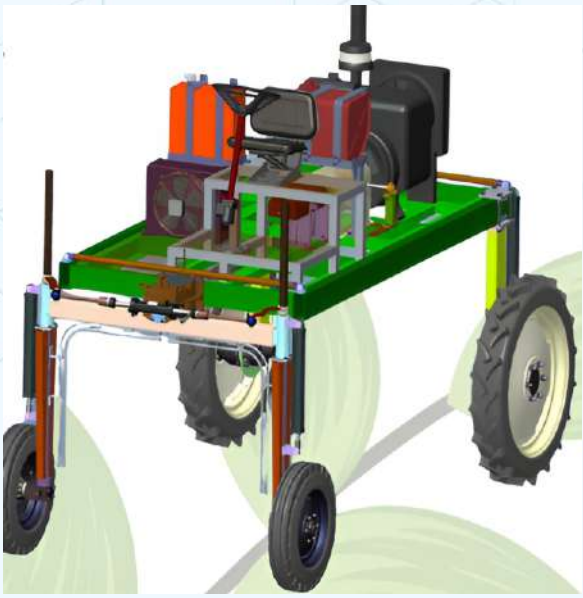
The electric power-driven robotic platform is specifically engineered for harvesting Red Velox apples in Kashmir's high-density orchard environments. It features a custom six-degree-of-freedom serial manipulator with an adjustable height and an indigenous non-articulated three-fingered gripper mounted on a four-wheeled, human-operated platform, ensuring mobility and flexibility. Additionally, a multi-sensory gripper with a vacuum suction pad enhances the system's capability for gripping spherical fruits. Integrated robotic controls include features such as obstacle detection, collision avoidance, and path planning within the ROS environment. The system autonomously detects, localizes, picks, and collects fresh ripe apples in orchards. The system is currently deployed at Sher-e Kashmir University of Agricultural Sciences and Technology (SKUAST) for trial and algorithm fine-tuning before commercialization.



Vision guided AI enabled robotic Apple harvester

Tea harvesting Unmanned Robotic Platform for North-East Indian tea Plantation (TULIP)

The low-cost robotic harvester is specifically designed to selectively harvest tender tea leaves (Two leaves and a bud) from tea plants. Central to its design is a 3-axis Cartesian robot made of mild steel, enabling precise plucking operations. The harvester functions on a platform that supports both remote-controlled and self-driven modes, facilitating efficient navigation across fields. Harvested leaves are handled using a mechanical blower and conveyor belt system, ensuring minimal damage and organized storage. Integrated AI-based vision systems enhance the precision and selectivity of leaf identification and localization in real-time. These technological advancements aim to boost agricultural productivity while reducing labor costs. TULIP is currently operational and undergoing trials at Tea Research Association, Jorhat, Assam.



TULIP Robotic harvester

Autonomous Robotic Platform for paddy cultivation: SAMA-DHAN

SAMA-DHAN is a versatile four-wheeled robotic vehicle designed for precise navigation in both autonomous and remote-controlled modes, tailored for agricultural applications. Equipped with multiple cameras and spraying nozzles for real-time "see and spray" operations, it excels in maneuverability with individually steerable wheels, ideal for navigating paddy fields. High ground clearance supports field inspection tasks until plants mature, with provisions for attaching implements like seeders, making it adaptable for various crop cultivation operations. At its core is an onboard edge computer, the Vehicle Control Unit (VCU), connected to a remote PC via long-range Wi-Fi for operational control and field monitoring. Features include unique RTK-GPS navigation with IMU technology for muddy paddy fields, seed sowing, various spraying functions (fertilizer, weedicide, pesticide), and plant health monitoring including chlorophyll content estimation, seedling count, and disease detection (e.g., blast and brown spot). SAMA-DHAN is trial-tested at Birsa Agriculture University, Ranchi.

Smart Vision Sensors

Thermal Smart Camera (TvITS)

TvITS is an AI-powered thermal sensor-based smart camera designed for road traffic applications, including vehicle presence detection, counting and classification, and pedestrian counting. It ensures data accuracy in all lighting conditions (complete darkness or glaring sunlight) and weather conditions. The camera's lens mount allows for interchangeable lenses to accommodate various application requirements. A Thermal Smart camera was installed at the Vellayambalam junction in Thiruvananthapuram as a vehicle detector sensor and integrated with the traffic controller to optimize signal timing.

Thermal Camera

CMOS Smart Camera

Industrial vision sensor (iVIS) is an industrial smart camera, which has a CMOS image sensor and a powerful on-board processing system capable of supporting Machine Vision Applications. iVIS is capable of extracting application-specific information from the captured images and make decisions based on the image processing algorithms implemented on the system, to realize stand-alone intelligent and decision-making automation system. Installed the IVIS Smart CMOS camera for the OSIS field trial at E.I.D Parry, Puducherry, Tamil Nadu & installed the IVIS Smart CMOS camera hardware for the Leather defect identification application at CEERI, Chennai, Tamil Nadu.

Key outcomes include General Purpose Thermal camera, Thermal Vision sensor for road traffic applications (TvITS), Industrial Smart CMOS camera (iViS-Smart), Industrial 10 GigE CMOS camera (iViS-10GigE), Online Sucro Crystal Imaging System (OSIS), and Machine Vision & Imaging software (AiVisionPro). It was funded by the Ministry of Information Technology (MeitY). The technology transfer of Smart thermal cameras was extended to nine industrial partners.

CMOS Camera

Power Electronics and Renewable Energy

C-DAC is engaged in the research and development of power electronics and renewable energy technologies, aiming to enhance energy efficiency and sustainability. The work includes the development of smart grids, energy management systems, and advanced power converters for renewable energy sources, etc. Various solutions developed by C-DAC in this area are as below.

National Mission on Power Electronics Technology (NaMPET)

The National level R&D Programme facilitating Research, Development, Deployment and Commercialization of Power Electronics Technology by enhancing the indigenous R&D expertise and infrastructure in the country with active participation from R&D institutions, Academic institutions and Industries. More than 20 Academic Institutions and about 25-30 Industries are actively participating in technology developments and manufacturing through ToT.

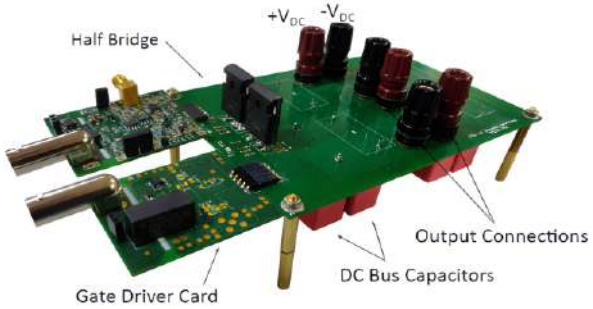
Wide Band Gap (WBG) technology application with devices and sensors are being addressed for the first time in Power Electronics systems. WBG based state-of-the-art Power Conditioner @25kW for Microgrid is commissioned and field operation inaugurated by Hon. Secretary, MeitY at Elephant Rehabilitation Centre, Kottoor, Kerala.

WBG high performance sensor technology

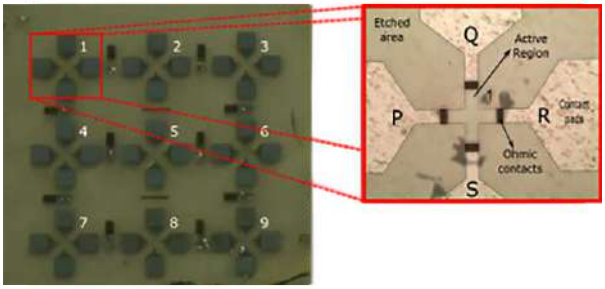
WBG sensor technology PoC is done for Magnetic field, Torque and Vibration and ready for technology Transfer for prospective sensor device manufacturers.

High bandwidth magnetic field sensor and current sensor, is inevitable for high frequency power electronics converter applications and Machine drives. The magnetometer is based on GaN WBG material technology which provides high accuracy and thermal properties.

Rogowski Coil for module type devices



DC-DC converter with embedded current sensor



Batch fabricated GaN on SiC Hall sensors

Handheld magnetometer -PoC

Vehicle Control Unit (VCU)

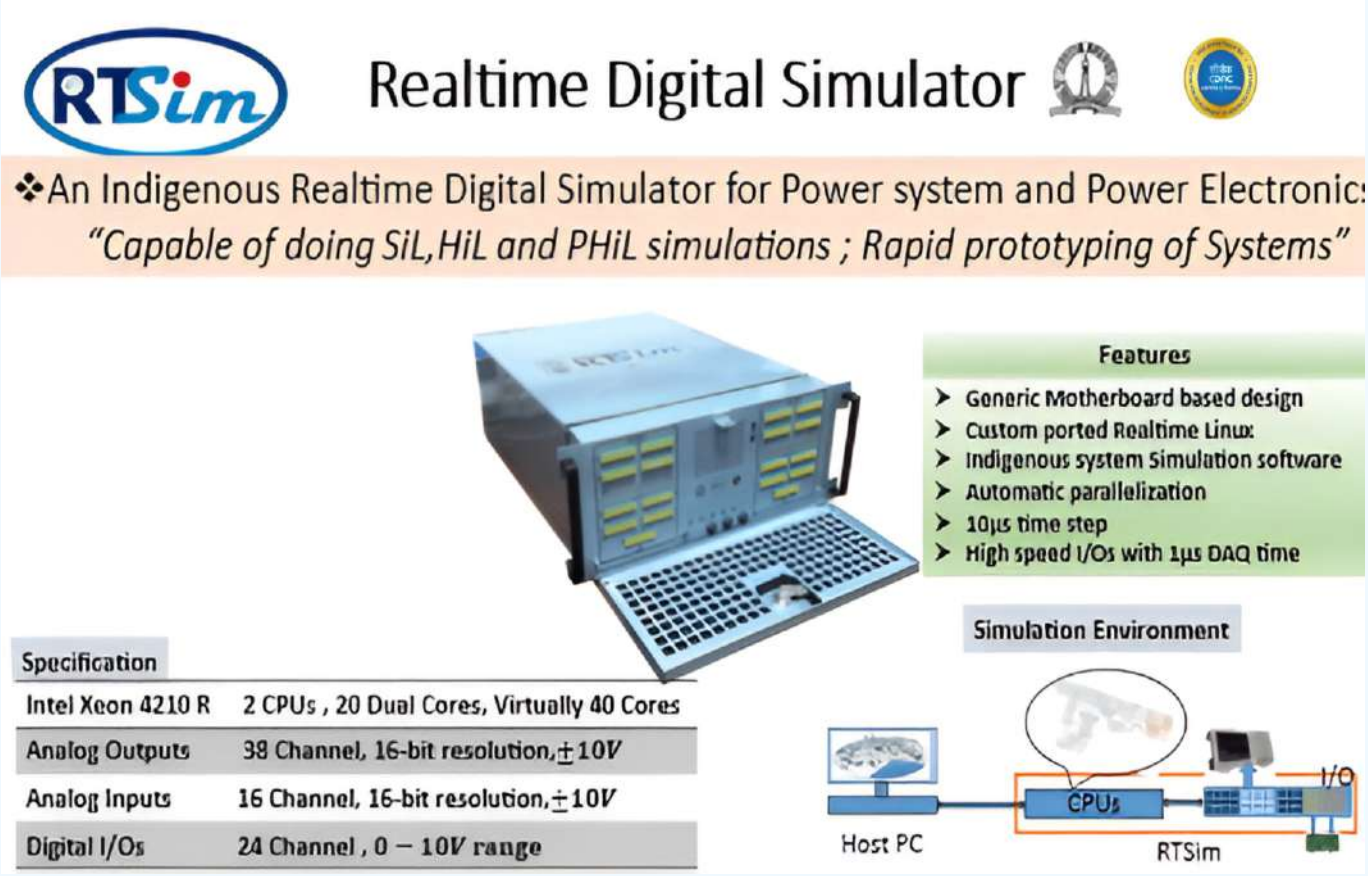
C-DAC Vehicle Control Unit (VCU) technology is powering more than 1700 Trains both in Passenger and Freight category. Long term VCU handholding is initiated for another 5 years by Railways. DPR for 5 Mega Watt propulsion technology for 3 Phase Electric Locomotive submitted with active participation from Railways and 4 Industries.

Smart Energy Meter (SEM)

Smart Energy Meter (SEM) technology has been accepted by 12 Industries and M/s GEPDEC, Noida cleared IS certifications and started pilot production and deployment initiated in KSEBL distribution. Deployment in Military camps with CERTIN Certification for C-DAC SEM and AMI is initiated. First SEM platform with DIR-V VEGA processor is developed and verified for functionality.

Green Energy Solutions

Commercial turnkey deployments of 1 MegaWatt Power Plant and 48VDC powering for 5 storied building with C-DAC technologies are getting commissioned for ANERT and KDISC. Real time digital simulator for Power system is first of the kind indigenous Power system real-time simulator configured for IISc, Bangalore.



Realtime Digital Simulator

Model Electric Vehicle (EV) Charging Station

The Model Indigenous Electric Vehicle Charging Station is setup at C-DAC Thiruvananthapuram, Technopark Campus. This center will have various AC and DC fast chargers, and monitoring tools for user interfaces for vehicles ranging from 2W to Heavy vehicles and play a crucial role in catalyzing an ecosystem for the promotion of the charging infrastructure knowhow with Industries and related stakeholders. This shall support EV chargers research, development, commercialization and manufacturing through industries.

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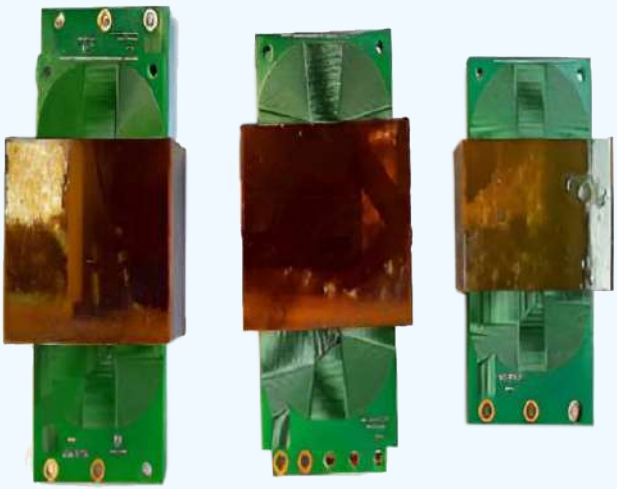
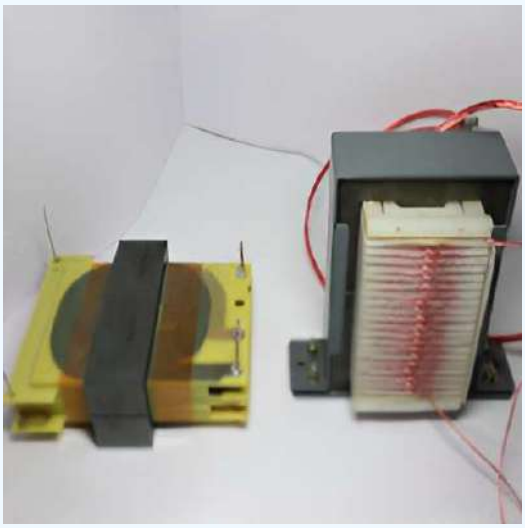
Model EV Charging Station

Planar magnetic Components

Magnetic components are integral part of any power electronic systems. The industries and scientific establishments involved in developing high frequency power supplies will be interested. Another domain which will be interested in automotive applications where low profile is attractive. With the attractive attributes of overall size reduction and improved efficiency, high frequency power conversion is established as one of the major areas in power electronics. High-frequency (HF) transformers and HF inductors are major components involved in high-frequency power conversion. These magnetic components are made of planar technology where windings are formed by the traces of printed circuit board (PCB) and these PCBs are placed in low profile ferrite core.



(a) Planar Transformer,
(b) & (C) Planar Inductors



10kV Planar Transformer (left)
10kV Conventional Transformer (right)

Currently, Technology of High voltage (of the order of 10kV), High frequency (of the order of 250 kHz) Planar Inductor and Transformer design knowhow is developed. To support users regarding the complex design parameters and methodologies, a Tool for design of planar components is also available.

Technology transfer process has been initiated and discussions regarding custom design of higher performance planar magnetic components for radar power supply is initiated with LRDE.

Centre of Excellence (CoE) for Products Based on Li-ion Cells (Post-Cell)

A "Centre of Excellence" (CoE) has been established at C-DAC, Noida under the project "Establishment of Centre of Excellence (CoE) for Products Based on Li-ion Cells (Post-Cell)" financially supported by Ministry of Electronics and Information Technology (MeitY), Government of India, and the Department of IT & Electronics, Government of Uttar Pradesh to create an eco-system for electronics industries with the requisite infrastructure, equipment, R&D facilities for design & development and testing of electronic products. The CoE shall serve as a design hub for SMEs in the mobile handset and accessories eco-system products based on Li-ion cells.

Centre of Excellence (CoE) for Products Based on Li-ion Cells

Main objectives of the CoE are to provide requisite R&D, Design & Testing infrastructure to local industries to make India self-reliant in mobile manufacturing sector, To seed a design hub for SMEs in the power bank industry and other mobile handset and accessories eco-system products based on Li-ion cells (Post-cell), To provide complete cycle of design, development & commercialization of the products, To build industry capable talent, start-up community and entrepreneurial ecosystem for products based on Li-ion cells (Post-Cell) and To save foreign exchange and generate employment for the masses.

A Centre of Excellence (CoE) has been established in association with the industry partner – India Cellular and Electronics Association (ICEA) for design and development of products based on Li-ion Cells such as mobile handset accessories.

Presently, the CoE has envisaged designing and developing of products related to mobile handset accessories and other electronic application products based on Li-ion cells like Power banks, Chargers, Wireless Chargers, Bluetooth Speakers, Smart Lighting Systems, Digital Radio, Headphones, Wearables, Battery Monitoring Systems for EVs, Solar System Battery Pack, GPS Navigation System, UPS System, Sountimeter and Ticket Vending Machine.

Besides this, a fully functional testing lab has been established at CoE which is proposed to be used by Bureau of Indian Standards (BIS) for certification and to provide testing support for in country and global needs. Also, the CoE hosts facility for skill development in electronic system design to bridge the gap in skilled manpower requirement of the country including the development of SMEs in the mobile industry & other electronic domains.

Other Technologies

Power amplifier development for Sonar application initiated for NPOL, DRDO. High voltage (100kV) power supply for X-Ray and Portable refrigerator for effective Vaccine transportation in remote locations will be crucial development for medical sector.

Green Energy Microgrid for remote Villages

The state of the art technology for Power Conditioning Unit (PCU) for Microgrids at remote locations is developed. Weak distribution grid (remote places, forest area etc.) can be supported with Micro-grid, incorporating PCU capable of on- grid and off-grid operation. SiC based high frequency compact Power Conditioner (25kW) suitable for container deployment- less than half the size of 50Hz conventional PCU design is achieved. MoU signed with M/s Tata renewable energy and microgrid for technical collaboration.

Wireless charger for LMVs

High Power Wireless charger technology at 1.5kW, across 10-20cm for EV charging is developed for the first time. PoC is verified with a 3 Wheeler application. Development done in association with domain experts at VNIT, Nagpur. Technical activities for efficiency enhancement and higher power transfer @5kW is being continued.

DLMS test tool for Smart Meter

All smart meter designs need to be evaluated for compliance to communication protocol, DLMS and parameter verifications as per standards. This is usually being carried out as part of certification process by agencies like Central Power Research Institute (CPRI).

Through MeitY initiative, indigenous DLMS and parameter test tool for Smart meters as per Indian Standards is developed in association with CPRI, Bangalore. It is a unique solution for expensive imported test tolls currently being used.

Communication Technology

C-DAC has been involved in development of various communication solutions for professional, military and strategic sectors in collaboration with defense labs, industries and academia. During this year, major achievements include receipt of commercial orders and initiation of new Research & Development (R&D) projects in these areas. Various solutions developed by C-DAC in this area are as below.

C-DAC TETRA Network (CTN)

The C-DAC TETRA Network (CTN) is an indigenously designed and developed secure, digital, wireless communication solution based on the ETSI TETRA standard for public safety and critical communication. As on date C-DAC has developed 25 products (including hardware and software products) under the CTN portfolio, which is open for Transfer of Technology (ToT)/Licensing to industry. CTN based communication solutions have been already deployed at 5 locations in India. A subset of the products from the CTN portfolio is already under ToT/Licensing to Industry partner and forms the backbone of the indigenously developed "Helo-Deck Communication System" for Indian Navy ships, being implemented by the industry partner.

Xtreme TETRA Base Station (800 Mhz)

Xtreme TETRA Base Station (XTBS) is the flagship product in the C-DAC TETRA network (CTN) portfolio. The first variant of XTBS operates in the 400 MHz bands (380-400 MHz & 410-430 MHz) supported by TETRA standard. C-DAC has now upgraded the RF front end of XTBS in order to support 800 MHz bands (806-824 & 851-869 MHz) as well, while retaining the rest of the architecture identical to that of the previous variant. The key features of the two-carrier XTBS developed under this initiative include: ETSI 300 392-2 (TETRA) compliant air interface, Rx Band: 806-824MHz, Tx band: 851-869MHz, Duplex Spacing: 45 MHz and Power class 2 (configurable up to 25 W).

Xtreme TETRA Base Station (XTBS) - 800 Mhz

Software Licensing - Apart from the new technology development, during this year, C-DAC also received an order for Software Licences for 14 sets of CTN products, which are already under ToT / Licensing, from the industry partner.

Software Defined Radio (SDR)

The term Software Defined Radio (SDR) refers to a radio platform which can take different radio personalities based on the radio application software that runs on it. The major use cases of SDR are (a) military communications and (b) research, experimentation and real-world validation of new methods & techniques in wireless communications.

Programmable platform for Experiments & Academic Research on SDR (PEARS)

PEARS is an indigenously developed SDR development platform (SDR-DP) that offers a compact and affordable facility to academia and research community for hands-on exploration of different aspects of wireless communication. The platform not only enables experimentation with various wireless technologies ranging from legacy AM/FM communications to state of the art technologies in 4G- LTE & cognitive radio, but also provides an ideal platform for quick & easy implementation & validation of new ideas, algorithms, techniques and even architectures. C-DAC has now extended the capability of PEARS (SDR-DP) by incorporating the Programmable Logic (PL) accelerator feature. Using this feature, the user can harness the signal processing capabilities of the PL fabric of the on-board Zynq SoC.

Key Features of PEARS include - Zynq SoC based platform powered by Dual core ARM processing system + Kintex 7 FPGA fabric, Comprehensive support for GNU radio environment, Rapid prototyping of wireless communication modules/systems using drag and drop from a set of configurable communication/signal processing blocks, Seamless exchange of IQ data between the PEARS platform and the GNU radio environment, Excellent signal processing power with 400+ DSP slices and Computation intensive routines can be ported on to FPGA fabric for accelerated processing.

PEARS Platform

The PEARS platfform, with this value addition, is being considered by some of the major labs, mainly in the defence and strategic sectors, including the Military College of Telecommunication Engineering (MCTE) and Directorate of Signal Intelligence as an indigenous platform for experimentation and prototyping of proprietary applications of theirs.

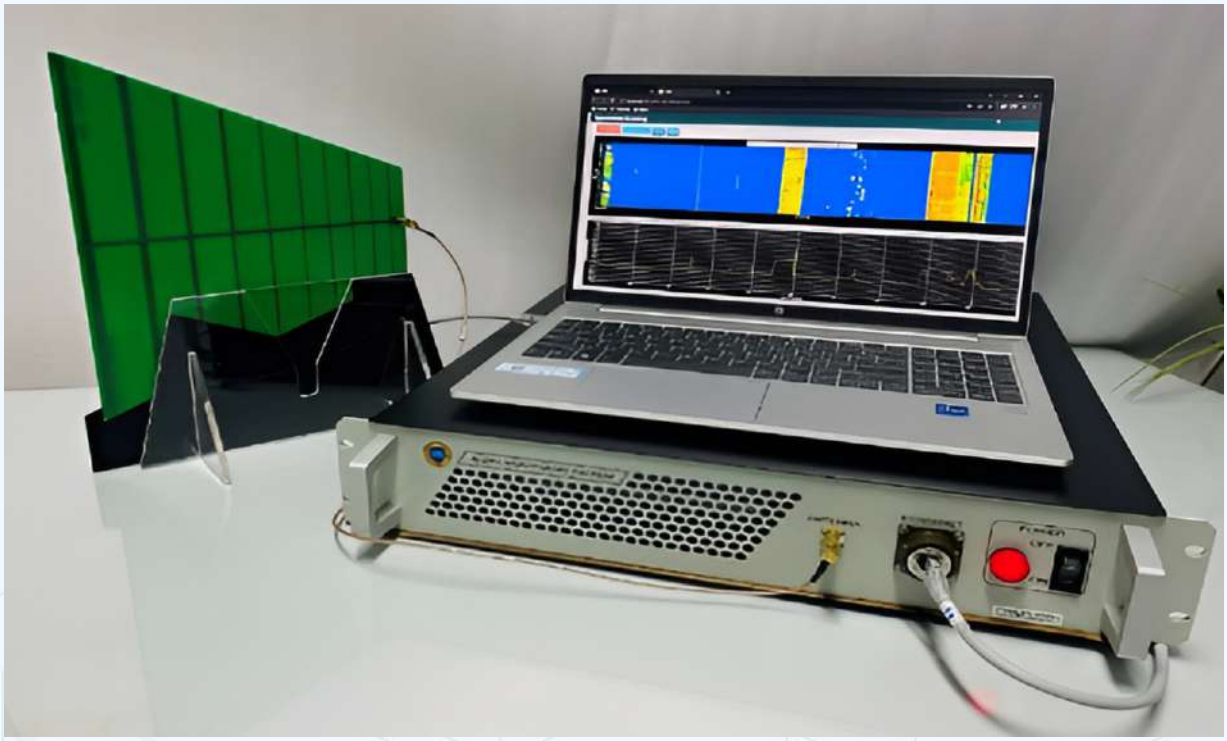
Spectrum Sensing

Spectrum Sensing (monitoring of the RF environment in the vicinity of the radio receiver) has emerged as a key enabling technology in modern radio communication systems. It is particularly relevant in military and strategic applications like signal intelligence and is a necessary requirement for achieving “spectrum superiority” over the adversary. This technology is also useful for regulatory agencies and wireless service providers to ensure transmission compliance. Spectrum Sensing is also an integral part of the emerging technologies like Cognitive Radio.

Radio Monitoring System (RMS)

C-DAC Radio Monitoring System (RMS) emerged as a value-added outcome of the recent work carried out by C-DAC, with support from CC&BT Group of MeitY, in the Cognitive Radio and related technological domains. The Spectrum Sensing module developed as part of these efforts has been re-purposed through software upgrades and product engineering to realise a Radio Monitoring System. The C-DAC RMS is designed for wideband spectrum monitoring offers instantaneous digitization bandwidths of up to 192 MHz with frequency coverage from 100 MHz to 2 GHz. The product houses AMD Zynq SoC and thus offers significant on-board computational horsepower for real time data analysis. The product is based on software defined architecture and supports feature addition and performance enhancement through software upgrades. The product comes along with a Graphical User Interface (GUI) running on a desktop/laptop PC connected to the RMS though Ethernet interface. The GUI could be used for configuring the platform, data visualisation and facilitating data capture as well as for remote access to the RMS. Radio Monitoring System caters to diverse use cases like Signal Intelligence, ensuring transmission compliance and interference management. Defence Forces, Border & Coastal Security agencies, Law enforcement agencies, Regulatory Agencies, Wireless Service Providers, Equipment Operators, Broadcasters and Facility Managers are all potential beneficiaries of this product.

Key Features include SDR based receiver architecture, Frequency Coverage: 100MHz - 2GHz, Instantaneous bandwidth up to 192 MHz and Sweep rate of 192 GHz/s, Configurable resolution bandwidth, On-board hardware acceleration support for real-time analysis and demodulation, I/Q data capture support for offline analysis and Data Visualisation using spectrum and spectrogram.



Radio Monitoring System

Internet of Things (IoT)

IoT proliferates into every walk of our life. C-DAC's indigenously developed single-phase energy meter, Agnivesh: the early fire alarm, battery monitoring system and water meter are all targeted to make our homes and cities smarter. To make the IoT space secure, a 'handbook of IoT device security' was recently launched. Initiatives have been taken to develop PKI based digital certificates for IoT device security. Various solutions developed by C-DAC in this area are as below.

Products for Smart Home - Smart City

Single Phase Energy Meter for Homes

C-DACs smart energy meter for single phase electricity consumers is an important realization towards smart homes and smart cities. It enables remote collection of basic and derived parameters like Active/ Reactive/ Apparent powers and also enables remote connect / disconnect of load. The indigenously developed meter is compliant to BIS 16444, & BIS IS15959 (functionally equivalent to DLMS-COSEM) standards and supports Over-The-Air firmware Upgrade. It notifies Utility Service Provider for various Tampers / Events and has a battery backup of up-to 2 years with data retention up-to 10 years. While the smart energy meter has communication support for 4G-LTE Cellular as well as optical port for reading tariff etc., yet it is highly secure as it uses AES-GCM-ECB Algorithm for data transmission. A complete Advanced Metering Infrastructure (AMI) comprising of Head-End System (HES), Meter Data Management System (MDMS) and Unified Billing System (UBS) has also been developed to complement the Single Phase Whole Current Smart Energy Meter and provide the entire bundle as a ready-to-deploy solution for various Utilities, Urban Local bodies (ULB) and Smart Cities.

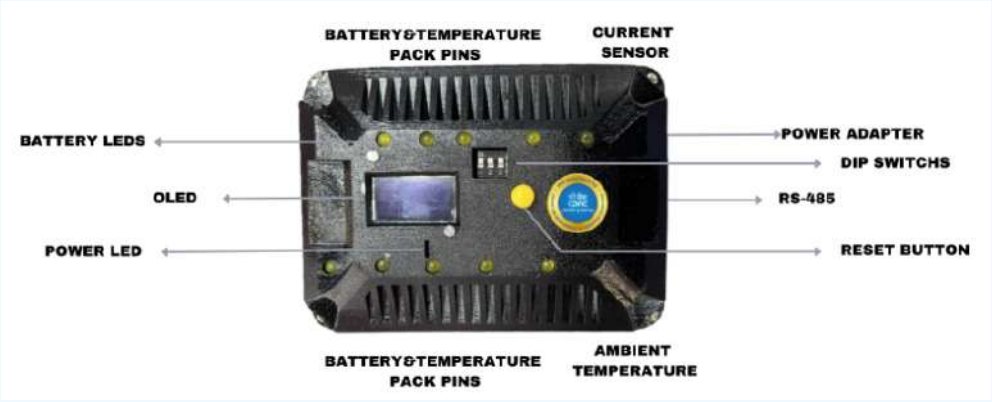
Single Phase Energy Meter for Homes

IoT enabled Battery Monitoring System

Uninterruptible Power Supplies (UPS) have been serving households and industries for a long time to meet the power requirements in case of sudden power supply failures. The UPS, in turn, is highly dependent on the batteries and issues like battery failure due to increased temperature, overcharging or deep discharge, etc. can cripple the entire power back-up system.

To meet this requirement, C-DAC's IoT enabled Battery management system (BMS) is a complete solution with centralized platform for monitoring various power backup devices for their health, operational status and other parameters on-site as well as remotely. It measures the parameters like voltage, current & temperature of each battery pack in the battery bank during charging and discharging cycles and computes the internal resistance of each battery, state of charge, remaining runtime, remaining capacity etc. The data is displayed on the OLED display and is sent to the remote server/cloud where the user can assess the data anytime with a user-friendly modular dashboard. The web interface provides a comprehensive data presentation in three distinct user access layers. The users can also remotely set threshold for alarms and notification SMS / email for various conditions /events.

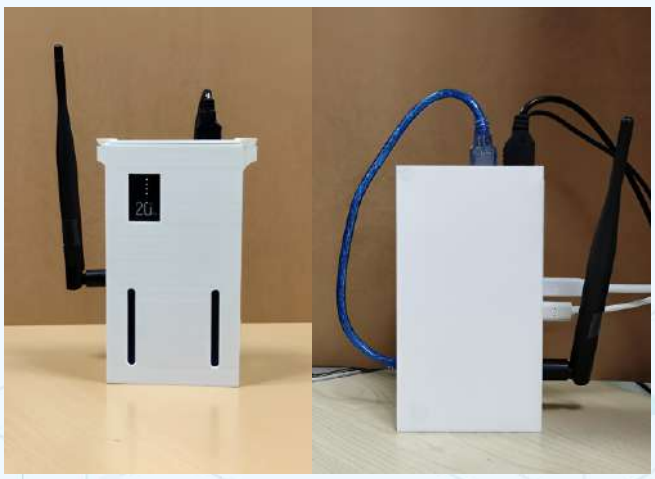
The robust system supports multiple battery chemistries, with up to 10 batteries per device and a provision for daisy-chaining to monitor much larger set of battery banks. The system supports communication over RS-485 (MODBUS-RTU), 4G-LTE Cellular and Wi-Fi wireless communication through MQTT protocol. The system is highly useful for 24x7 monitoring of power backup systems in industries, data-centers and domestic use case scenarios.



IoT enabled Battery management system (BMS)

Agnivesh: Wireless Early Fire Detection System

Agnivesh is an early fire detection solution that is both portable and low powered. It consists of battery-operated sensor modules, wireless routers, and a gateway for data aggregation. Employing ZigBee technology for data communication, it operates as a standalone system, offering features such as data storage, visualization, and alarm notification. The sensor nodes are equipped with smoke and heat sensors, with sensitivity ranging from 0.5 to 3.5% obs/foot for smoke and a temperature range of 20°C to 60°C. These nodes have a battery life of 60 days, operating at 12V voltage, and undergo battery monitoring every 6 hours, with the option for configuration. Event-based alert generation ensures timely response to potential fire hazards. Key features include near real-time fire detection, long battery backup, Zigbee communication, event-based alerts, and dashboard visualization.

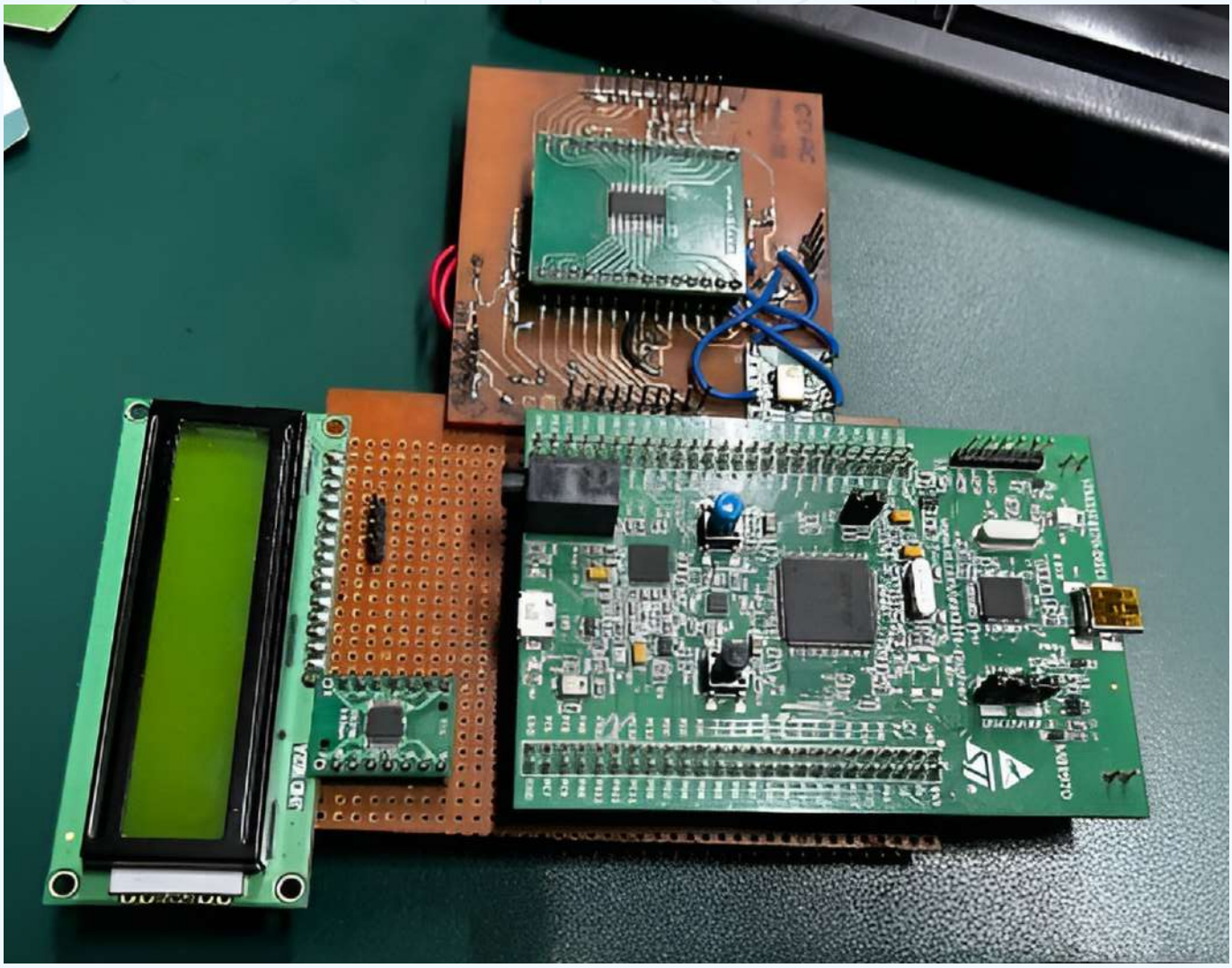


Agnivesh: Network Nodes

Agnivesh: Sensor Node

C-DAC's Smart Water Meter

C-DAC's smart water meters are yet another trustworthy solution for use in smart cities. It is an electronic meter that uses ultrasonic wave propagation times between two transducers placed strategically in the pipe, to accurately measure the liquid flow rates. The eco-friendly product is specifically designed for Indian environment and can be installed in any position. The temper proof meter has Built-in provision for radio communications and it retains the last data even when power is switched off. The product is ready and available for transfer of technology.



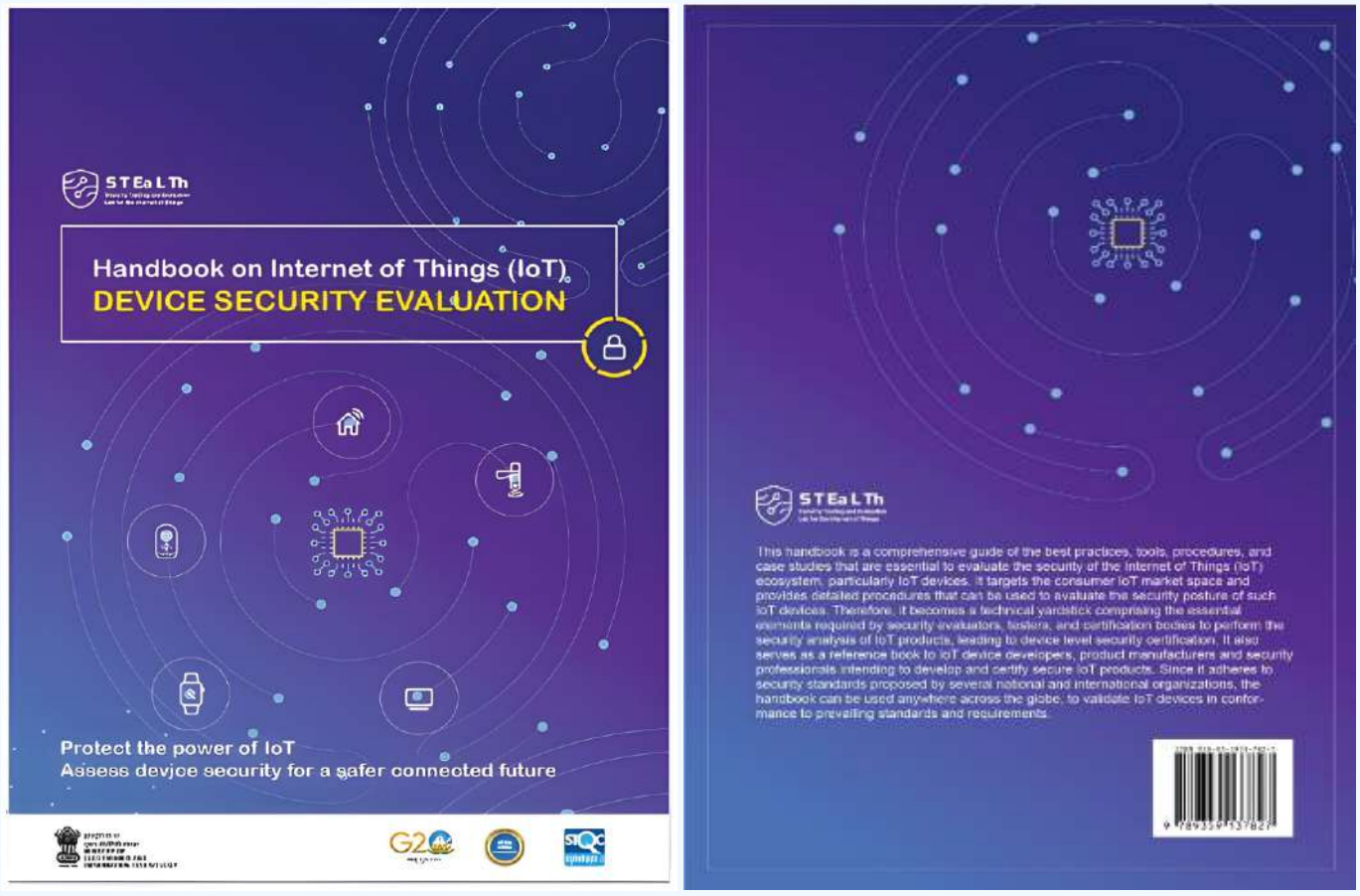
C-DAC's Smart Water Meter Board

Other Work

Handbook on the Internet of Things (IoT) Device Security Evaluation

The handbook is a unique compilation that offers detailed procedures and mechanisms for the security evaluation of IoT devices. It is based on global IoT security standards, which define the essential security requirements for developing secure IoT devices. The lack of scientific and methodological procedures for security testing of IoT devices has created a challenge in assessing the security posture of these devices used in various applications and infrastructures. This challenge is effectively addressed by the handbook.

The procedures outlined in the handbook provide comprehensive testing knowledge by describing the test setup, necessary tools with their manuals, assumptions, dependencies, and the scope of testing. To enhance understanding, the handbook includes easy-to-follow test cases performed on commercially available consumer IoT devices. The evaluation of the IoT device's security is achieved by assessing security requirements related to the IoT ecosystem, user application, operating system, communication, and hardware. The handbook also incorporates case studies and demonstrations using popular consumer IoT devices such as surveillance cameras, smartwatches, and smart locks. The handbook should serve as a valuable resource for ensuring the security of IoT devices.



Handbook on the Internet of Things (IoT) Device Security Evaluation

Capacity Building and Training Activities

In today's age of rapid technological advancements, Capacity building, Training and upskilling are crucial for staying competitive and relevant. Continuous learning enables individuals and organizations to adapt to new tools and methodologies, fostering innovation and efficiency. By investing in skill development, we ensure a future-ready workforce capable of navigating the complexities of a tech-driven world. C-DAC has been contributing in the area of Capacity Building and Training as given below.

Capacity Building

FutureSkills PRIME

FutureSkills PRIME project is an upskilling/reskilling initiative launched by Ministry of Electronics and Information Technology (MeitY) in association with NASSCOM aimed at enhancing skills and knowledge in emerging technologies, viz, Additive Manufacturing/3D Printing, Artificial Intelligence, Augmented/Virtual Reality, Big Data Analytics, Blockchain, Cloud Computing, Cyber Security, Internet of Things, Robotic Process Automation, Social & Mobile, etc. C-DAC is the Project Management Unit (PMU) for the program. The program featured 5 category of Courses including Foundation, Deep Skilling, Bridge course, Government Officer Training and Training of Trainer Program to train around 4,12,000 Beneficiaries as part of Phase 1 through FSP Platform and Blended Learning initiatives.

For the year 2023-2024, the C-DAC/NIELIT system has reskilled/upskilled 2143 Government Officers across 50+ Government organizations including MeitY, NIC, DRDO, SEMT, NITTTR, Punjab Police, Income Tax Department, Delhi Police, Department of IT CRPF, ITILT-Telangana, AAI, Kerala Police, BEML, Delhi Cyber Police, CIT Dept, CISF, National Health Mission, IRCTC, STQC, CSIR etc. Towards these 873 trainers in Emerging Technologies were also skilled across Lead/Co-Lead Centres and Spokes. Further around 13,879 beneficiaries were reskilled/Upskilled through 13 Bridge Courses developed by 40 Teams of 22 C-DAC/NIELIT Centres. The major achievement of the FutureSkills PRIME include overall 18 Lakh+ registrations, 8 Lakh+ Course enrolments, 2000+ Course/Pathways, coverage to 2000+ Academic Institutions and 10+ State government partnerships and coverage across 700+ cities including Tier 2 and Tier 3 cities as part of reskilling/Upskilling Ecosystem. Further, such large-scale current uptake and futuristic talent requirement in Emerging Technologies as per various National & International Reports contributed towards extension of the Program to Phase 2 by MeitY with upgraded Course Categories and an augmented Target of reskilling/upskilling 10 Lakh+ Beneficiaries over the period of 3 years by 2027.

The FutureSkills PRIME program has been ranked 3rd out of 47 initiatives globally by European Commission Report on 'Pact for Skills: Analyzing of up and reskilling policy initiatives and identifying best practices' in 2023 in benchmarking results based on "Total Average Key Performance Metrics" and been ranked as 1st in benchmarking results based on "Total Average Key Performance Drivers'.

Benchmarking results based on Total Average Key Performance Metrics

TOP initiatives with the 5 highest scores in this category	Country	Score (max. 5 points)
Skillnet Ireland	Ireland	5
Digitalízate	Spain	4,89
FutureSkills Prime	India	4,67
High Road Training Partnership	United States (California)	4,67
SkillsFuture Movement by SkillsFuture Singapore (SSG)	Singapore	4,56
Digital Skills for Bulgarian SMEs	Bulgaria	4,56

Benchmarking results based on Total Average Key Performance Drivers

TOP initiatives with the 5 highest scores in this category	Country	Score (max. 5 points)
FutureSkills Prime	India	4,39
SkillsFuture Movement driven by SkillsFuture Singapore (SSG)	Singapore	4,37
Hiroshima Prefecture Reskilling Initiative	Japan	4,33
Skillnet Ireland	Ireland	4,29
High Road Training Partnership	United States (California)	4,16

Source: Pact for Skills Analysis Report by European Commission, 2024

Swayaan

Project SwaYaan - Capacity Building for Human Resource Development in Unmanned Aircraft Systems/Drone & related technology is a MeitY funded initiative. C-DAC as Project management Unit (PMU) and Participating Institute for non-Formal Programs undertook various academic, training, research, innovation and knowledge enhancement activities with involvement of 30 premier Institutions including IISc, IITs, NITs etc. The technical areas covered included Aeromechanics, GNC Algorithm & Simulation, Drone Electronics, Drone Applications, and Allied UAS Technologies. These activities undertaken as part of the initiative include M.Tech degrees, Minor Degrees, Retrofitting initiatives, Bootcamps, IPR generation (Papers & Patents), Proof-of-Concept Projects, 6 months certificate courses, Workshops, National Competitions, International Conference and Faculty Development Programs. Through these range of academic, training, research, innovation, and knowledge enhancement activities, nearly 7,000+ beneficiaries, including UG/PG students, faculty, and research scholars, were benefitted nationwide in the domain of Drones and UAS, spanning 24 states and 50+ cities.

Among the project's significant achievements in 2023-2024 was the launch of several dedicated academic programs in Drone/UAS, including the MTech program in Unmanned Aerial Systems (UAS) Engineering, PG Diploma in Unmanned Aircraft System Programming (PG-DAUSP), and creation of Junior Engineer Drone (R&D) qualification pack. Additionally, 11 institutes introduced 3 minor degrees and 44 retrofitting electives. The activities also include 2 patents, publication of 20 research papers, and the development of 76 Proof-of-Concepts (PoCs). Further, Drone/UAS related laboratories were established in 25 institutions including IISc, 11 IITs/IIIT/IIITDM, 8 NITs, 5 C-DAC and 5 NIELIT Centres.

Basic Bootcamp Programme and Training activities

Enhancing Tribal Livelihoods with Traditional, Scientific, Technological Interventions

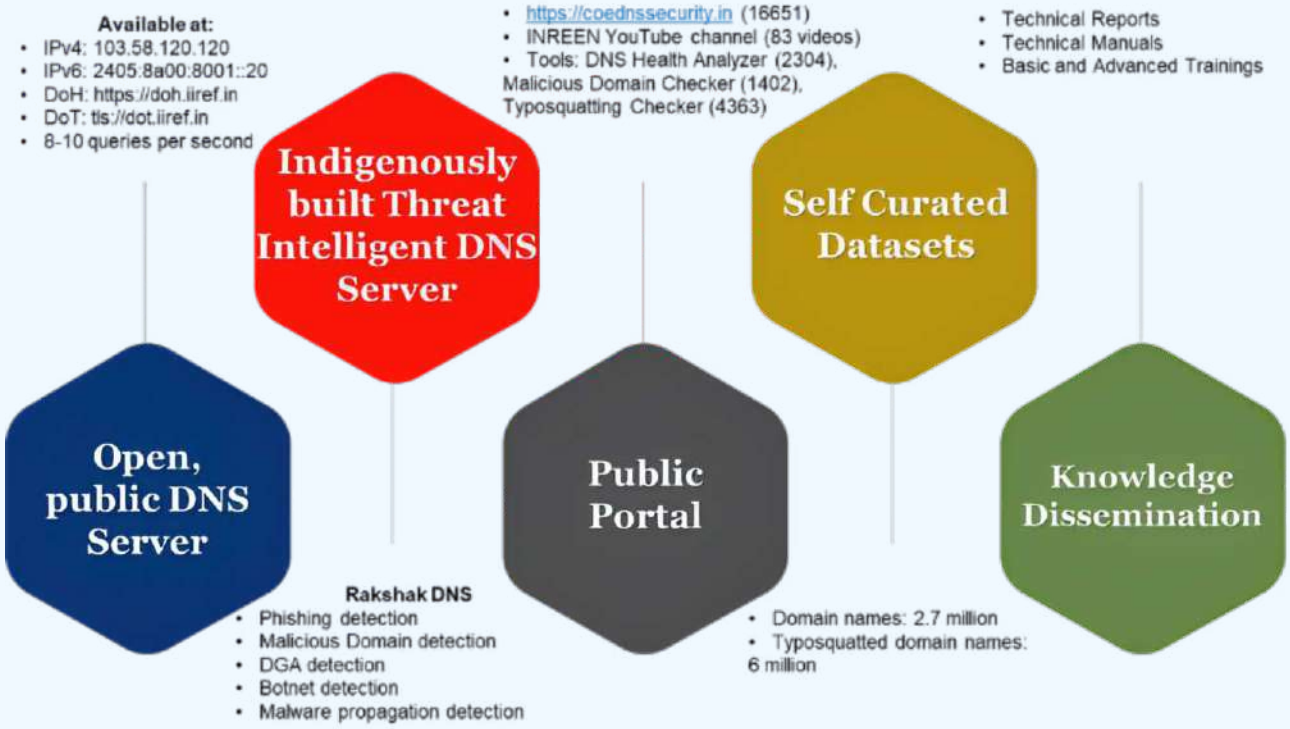
The project's primary objective is to enhance the livelihoods of the target population by identifying high-value medicinal plants and providing locals with the training for their organic cultivation, harvesting, and packaging. It also aims to document and preserve the traditional knowledge of medicinal plants of the region by creation of digital database of medicinal plants and Indigenous Knowledge Systems (IKS). The digital library created will be useful for both locals and the public for home remedies, disease management, and overall healthy living. The project is being implemented in collaboration with Symbiosis Institute of Geo-informatics, Pune and Adiwasi Samaj Krutee Samitee, Pune.

Centre of Excellence in Intellectual Property (CoE-IP)

CoE-IP is serving a diverse community of over 25,000 registered users, including innovators, startups, and MSMEs. It has successfully executed more than 7,500 Prior Art Searches, secured 580 Copyrights, and facilitated the registration of 185 Trademarks. Additionally, it has filed and maintained 430 patents on behalf of various societies under the Ministry of Electronics and Information Technology (MeitY). Internationally, it has filed over 90 patents, providing financial support to MSMEs and startups in the process. Our efforts have also extended to conducting or supporting over 120 workshops across India in collaboration with academia, industry bodies, and incubation centers. The Centre of Excellence in Intellectual Property (CoE-IP) is currently partnered with 51 Technology Incubation and Development of Entrepreneurs (TIDE) Centers, 15 Atal Innovation Centers, 21 academic institutions, 14 R&D institutes, and 200 startups.

Centre of Excellence in DNS Security (CoEDNS)

The Centre of Excellence in DNS Security has been setup conducting experiments and training in DNS Security, and involves establishing research frontiers in Security of DNS and Email Security. A Public DNS Resolver infrastructure for Internet users has been running successfully for about 5 years by receiving a daily traffic of about 10 million DNS queries on an average.



Centre of Excellence in DNS Security (CoEDNS) components

Next Generation Public Key Infrastructure for Smart Applications and Training in Digital Signature & PKI

A project for spreading awareness to adopt digital signature and PKI through direct, indirect, online and informal modes of training, develop applications based on PKI, conduct studies and research in different aspects of PKI, carry out experiments relating to use of PKI in IoT and leveraging Blockchain for PKI ecosystem. As part of the project, International Conference on PKI and its Applications (PKIA) is planned yearly once. This year it was organized during September in association with IEEE Computer Society and IEEE Industry Applications Society Bangalore Chapters. Proceedings of the conference is published in IEEE Xplore digital library. A learning platform is made available to learn PKI primitives through hands-on practice.

Open Challenge Competition for Development of Indian Web Browser

An open challenge competition for development of an indigenous Web Browser was launched to address the technological, indigenous & innovative requirements. The purpose of this challenge is to build an indigenous Indian Browser with built-in CCA India Root Certificate. The challenge was opened on August 09, 2023 and is currently in the final stage.

Set up for Internet of Things (IoT) lab and Formulation of IoT Security Testing Framework: Creating an Internet of Things (IoT) laboratory, Development of IoT Security Framework and a document on Security Assessment of IoT device networks including Log analysis and evidence analysis have been the key outcomes of this project funded by DRDO.

Information Security Education and Awareness (ISEA)

The Information Security Education and Awareness (ISEA) Project was approved with the objectives of capacity building in the area of information security, training of Government personnel, and creation of mass information security awareness for various user segments, with 50 Premier Institutes comprising of IITs, NITs, IIITs, State/Central/Technical Universities and C-DAC/NELIT Centres. Under the project ISEA phase II, so far, a total of 90,957 candidates have been trained/are undergoing training in various formal/non-formal courses in the area of Information Security through 52 institutions. In addition, five Technical Universities have reported that around 2.90 lakh candidates as trained/ are undergoing training in formal courses in their respective affiliated colleges. Besides this, 27,958 Government Officials have been trained in various short-term courses through direct/e-learning/VILT mode. As a part of awareness creation, 1,545 awareness workshops on Information Security have been organized through direct/virtual mode for school & colleges students, teachers, faculty, Government personnel, LEAs, general users, parents, women, CSCs, etc., covering 3,47,356 participants. Besides this, 1,24,909 school teachers have been trained as master trainers in 43 training programs. In addition, around 5.75 crore estimated beneficiaries have been covered so far through indirect mode.

Training and Internship Programs

Institutional Training Programs

C-DAC has conducted the IT training programs for personnel of Government sectors, Indian Armed Forces, IT companies, Insurance, Energy sector, Municipal corporations, Indian Railways, Town Planning and Commissions, Authorities along with various Ministries and Departments. In the last year C-DAC has conducted the Institutional training to the following Institutions:

- C-DAC provided specialized training for Southern Command HQ, Pune Cyber in areas such as Audit, Cyber Security, and Network Administration to 250 Indian Army personnel at locations including Pune, Secunderabad, Jodhpur, and Bhopal. This training aimed to certify and upskill personnel in these crucial areas for enhanced capability and preparedness.
- C-DAC conducted hybrid mode training for Defence Research and Development Organization (DRDO) personnel in Python, AI and ML, and Database Technologies. A total of 60 individuals were trained and upskilled in the Artificial Intelligence and Machine Learning domain through this initiative. A version control management system using Gitlab training is provided to DRDO personnel.
- C-DAC provided training in End Point Security for Indian Army personnel, funded by Armoured Corps Centre and School (ACCS), Ahmednagar. This initiative is aimed to enhance security expertise among the personnel involved.
- C-DAC provided training in Cyber and Communication Network Security for Indian Telecom Officers of National Telecommunication Institute for Policy Research, Innovation, & Training (NTIPRIT), Ghaziabad.
- In partnership with Himachal Pradesh Kaushal Vikas Nigam (HPKVN), C-DAC provided training in emerging

technologies like data science, cybersecurity, AI, and web design to unemployed youth in Himachal Pradesh, training 188 participants.

- C-DAC conducted short terms certificate courses in areas of Customized Course on Object Oriented Programming, Network Management, Basic Computer Application, Web Technologies, Customized Course on Object Oriented Programming & Web Development, Application Management, Networking, Security and Data Mining. Trained. Total 157 participants were trained from different organizations like DRDO, MoD (Ministry of Defense), CAPF (Central Armed Police Forces) i.e BSF, SSB, IB, CRPF, ITBP.
- C-DAC conducted training to Indian Coast Guard, Ministry of Defence, Government of India on AutoCAD 2D drafting & 3D modelling during: July - August 2023.
- C-DAC conducted training to Centre for Railway Information Systems (CRIS), New Delhi on Spring Boot & Flutter during: February to March 2024.

International Training Programs

- C-DAC conducted PG-Diploma courses for 6 international students in the March 2023 batch. The program included participants from Vietnam (5 students) and Argentina (1 student), all of whom successfully completed the training and received PG-Diploma Certificates from C-DAC.
- C-DAC conducted PG-Diploma courses in the September 2023 batch for 5 international students, with 3 students from Solomon Island and 2 from Argentina participating. These students successfully completed their training and received PG-Diploma Certificates from C-DAC.
- C-DAC conducted an online certificate course in web application programming under the e-ITEC scheme for 13 ITEC partner countries. A total of 36 participants from these countries completed the training and received certificates from C-DAC.
- C-DAC has trained 182 international participants in telemedicine, AI, and digital health.
- C-DAC conducted courses for international participants in niche areas of Machine Learning, Big data Analytics, Artificial Intelligence, IT Fundamentals and System Administration etc. One course in domain of Artificial Intelligence was conducted in Spanish language for 30 participants from 8 countries. Total 152 participants from 52 countries were trained.

All of the above-mentioned training programs were funded by Ministry of External Affairs, Government of India.

Post Graduate Diploma Training Programme (PG-Diploma)

C-DAC ACTS is recognized by the National Council of Vocational Education and Training (NCVET) with dual recognition as an awarding body and assessment agency. C-DAC is in process of aligning its courses to the NSQF and New National Credit Framework (NCrF) under the NEP 2020.

PG Diploma courses are conducted in the areas of Advanced Computing, Artificial Intelligence, Big Data Analytics, IT Infrastructure Systems and Security, HPC System Administration, HPC Application Programming, UAS programming, IoT Embedded System Design, and VLSI Design.

The admission to the PG Diploma courses through the C-DAC Common Admission Test (C-CAT) was held on January 13 and 14, 2024 where over 8700 candidates appeared for the C-CAT. The total seats offered for PG Diploma courses is 6590 seats in both Physical and online modes. The PG Diploma Course is commencing on March 05, 2024 across India in all training centres. A total of 3355 students are joining the PG Diploma courses in the March 2024 batch.

The C-DAC ACTS Common Campus Placement Programme for September 2023 batch students has been conducted with over 200 companies.

Work Based Learning

The Work-Based Learning Programme (WBLP) at C-DAC addresses this by equipping fresh graduate engineers from underrepresented communities with essential skills in cutting-edge technologies. Launched by the Ministry of Electronics and Information Technology (MeitY), this five-year project (ending in 2027) aims to enhance the employability of SC/ST/EWS/Women candidates through hands-on experience and exposure to MeitY's projects.

The WBLP curriculum goes beyond theoretical education, providing training in fields such as Artificial Intelligence (AI), Machine Learning (ML), Quantum Computing, Cyber Security, and Digital Health. Participants gain experience by working on live projects like eSanjeevani and the Emergency Response Support System (ERSS), guided by experts from MeitY's organizations. The program also emphasizes professional skills, including communication and problem-solving, preparing candidates for successful careers.

The Programme Management Unit at C-DAC aims to expand the WBL Programme's impact, ensuring it promotes inclusive growth and technological excellence. By empowering diverse talent and fostering innovation, WBLP plays a key role in developing a skilled workforce for India's digital future, reflecting the government's commitment to nurturing talent and driving progress. In 2023-24, the program has made significant progress. Over 1,400 candidates are currently enrolled across India at 81 branches of 7 MeitY organizations, receiving mentorship from industry experts and a monthly stipend. Upon completion, participants are certified for roles like Software Developers, Hardware Designers, and Testers. Notably, 763 candidates have completed their internship, with 192 placed by the PMU.

Formal Degree Programs

- M.Tech (CSE) programme is being offered since 2003. The intake is 25 students per year. The objective of the program is to produce postgraduates with advanced knowledge in one or more areas of Computer Science.
- C-DAC was conducting MBA-IT (erstwhile MBA-SEM), in affiliation with Guru Gobind Singh Indraprastha University (GGSIPU) since 2006. The programme is now offered as MBA. The programme is meant to transform the engineers to lead global businesses in an increasingly complex and dynamic environment. It is conceived, designed and structured as a Two-Year Full-Time Management Programme with dual specialization. Intake is 60 students per year.

Other Training Activities

- Programme for Advancing Computer Education (PACE) programme of C-DAC conducted 50 basic computing courses in Certificate, Diploma, Advanced Diplomas & PG Diploma courses under the PACE programme in the year 2023-24. A total of 28,407 students were trained through its implementing agencies (Authorized Regional Coordinators) and awarded certificates in various Certificate, Diploma, Advanced Diplomas & PG Diploma courses.
- Under DST sponsored training, C-DAC conducts summer training for B. Tech students in areas such as Generative AI, VLSI Design, Data Science, Cybersecurity, and Web design.
- Under E&ICT Academy Initiatives under MeitY Scheme, C-DAC rolls out FDPs for ITI/polytechnic faculty and PGTs, focusing on core subjects like Electrical Engineering, Electronics & Communication Engineering, and Computer Science, with a target of training 500 participants annually.
- Besides above, C-DAC is also conducting PG-DBA, PG-DRAT and other courses.

Resources, Facilitation Services and Initiatives

International Collaborations/Co-operations

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

- **India - Namibia Centre of Excellence in ICT (IN-CEIT) & HPC at NUST in Windhoek**

  Hon'ble External Affairs Minister of India, Dr. S. Jaishankar inaugurated India – Namibia Centre of Excellence in IT (IN-CEIT) setup by C-DAC at Namibia University of Science & Technology (NUST) in Windhoek on June 05, 2023. He was joined by Hon'ble Deputy Prime Minister of Namibia, Ms Netumbo Nandi Ndaitwah and Minister of Higher Education of Namibia, Dr. Itah Kandjii – Murangi in the inauguration ceremony.

- **India – Argentina Centre of Excellence in IT at Buenos Aires**

  The First Convocation Ceremony of the India-Argentina Centre of Excellence in Information Technology (IA-CEIT) setup by C-DAC with the financial assistance from Government of India in the University of Hurlingham, Buenos Aires was held on October 20, 2023. The ceremony witnessed the participation of the Argentine Minister of Education, Hon'ble Jaime Perczyk; Ambassador of India, H.E. Dinesh Bhatia; Rector of Hurlingham University, H.E. Walter Wallach; Technical Advisor to CEIT, Mr. Ankit Kumar and Argentine Master Trainer, Mr. Leandro Robles trained at C-DAC in India. It was also attended by 80 students who had successfully completed their training in the offered courses at IA-CEIT.

- **Setting up of Cyber Security Training Centre at National Defence University, Ulaanbaatar, Mongolia**

  C-DAC Resident Engineers have done the overall management of Cyber Security Training Centre and coordination with host government and Indian Mission in Mongolia during the period. The Cyber Security Training Centre was formally handed over to National Defense University, Ulaanbaatar, Mongolia on June 02, 2023.

- **Solomon Islands Centre of Excellence in IT (IS-CEIT) at Honiara**

  IS-CEIT organized a two-day workshop offering a platform for knowledge exchange and technological advancement during October 2023 and commenced classes for the Certificate courses from March 2024.

- A non-disclosure agreement has been signed between Flowable AG, Seilerstrasse 8, 3011 Bern, Switzerland (CHE-105.136.021) and C-DAC, Noida. This NDA has been signed for implementing the PoC for Low Code No Code platform.

Patents/Copyrights

Patents

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6. "Apparatus for Automated Monitoring of Facial images and a Process Therefor", Mr. Ritesh Mukherjee, Dr. Debasis Mazumder, Patent Number: 427739, Awarded, March 30, 2023.
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4. Artificial Intelligence (Ai) based apparatus for eliminating contaminants from processed tea, and method thereof, Mr. Tamal Dey, Ms. Abhra Pal, Mr. Gopinath Bej, Dr. Amitava Akuli, Mr. Tapas Sutradhar, Dr. Alokesh Ghosh, Mr. Jayanta Kumar Roy, Dr. Nabarun Bhattacharyya, Application No. 202331029181, India, Filed, April 21, 2023.
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6. "A Honeypot framework system for capturing Cyber Attacks", Mr. Rakesh Kumar, Mr. Saurabh Chamotra, Mr. Sanjeev Ror, Mr. Munish Verma, Mr. Kuwar Singh, Mr. V. K. Sharma, Application No. 202311036275, India, Filed, May 25, 2023.
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8. "Hybrid Intelligent Controller for Integrated Hydroponics and Polyhouse Applications", Dr. Mandeep Singh, Dr. Jaspal Singh, Dr. Balwinder Singh, Application No. 202311053004, India, Filed, August 7, 2023.
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10. "IOT based Aquaponics System", Dr. Mandeep Singh, Dr. Jaspal Singh, Design Application No., 403518-001, India, Filed, December 30, 2023.
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Copyright Filed

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2. “Rige-Sense: A Machine Vision Solution for Estimation of the Age of the Raw Rice”, Mr. Gopinath Bej, Mr. Santanu Kamilya, Mr. Tamal Dey, Mr. Arindam Niyogi, Mr. Tapas Sutradhar, Mr. Abhra Pal, Dr. Amitava Akuli, Dr. Alokesh Ghosh, Diary No. 7639/2024-CO/SW (India), Filed, March 11, 2024.
3. “iOncology.ai”, Ms. Lakshmi Panat, Ms. Swapna Yenishetti, Ms. Snehal Sapkale, Dr. Ganesh Karajkhede, Ms. Pritam Tambe, Ms. Abha Deshmukh, Copyright Application No. 6131/ 2024-CO/ SW, Filed, February 26, 2024.
4. “Method And System for Automatic Detection of nearest available Parking Lot and Vehicle Location Identification using Dead Reckoning”, Prakash Rosayyan, Sathyanarayanan Krishnamurthy, Satheesh Gopinathan Nair, Benoygopal E B, application No: 202341085880, filed, December 15, 2023.

Awards and Accolades

1. C-DAC Kolkata received 2023 SKOCH Silver Award in the E-Governance category for “Lekhani-Bishleshak" tool, an AI-powered solution for forensic document analysis at Delhi on February 10, 2024.

2. eSanjeevani-National Telemedicine Service - Won “Award of Notable Mentions” in the Award Category of “Telehealth Tech Pitch Competition” by IEEE SA” on August 11, 2023.

3. C-DAC Mumbai received award for ‘e-Pramaan National Single Sign On’ during 12th edition of iLogue and GovConnect Digital Transformation Conclave and Awards on November 24, 2023 at Leh in collaboration with Information Technology Department, UT of Ladakh.

4. eSushrut received award during the Arogya Manthan 2023 organized by National Health Authority (NHA) on September 25, 2023 for:

   a. Certificate of Appreciation for significant contribution in implementation and roll-out of ABHA 'Scan and Share' Service under Ayushman Bharat Digital Mission

   b. Top Performer award for AIIMS Raipur Application

5. C-DAC Noida received "35th Technology Sabha" excellence award in the "Enterprise Applications" Category for e-BIS Ease of Doing business platform developed for the Bureau of Indian Standards at KOLKATA on March 1, 2024.

6. C-DAC Silchar received 8th eNorth East Award 2023 in Health & Well Being category for implementation of DVDMS for health department of Government of Nagaland on Nov 25, 2023 at Guwahati, Assam.

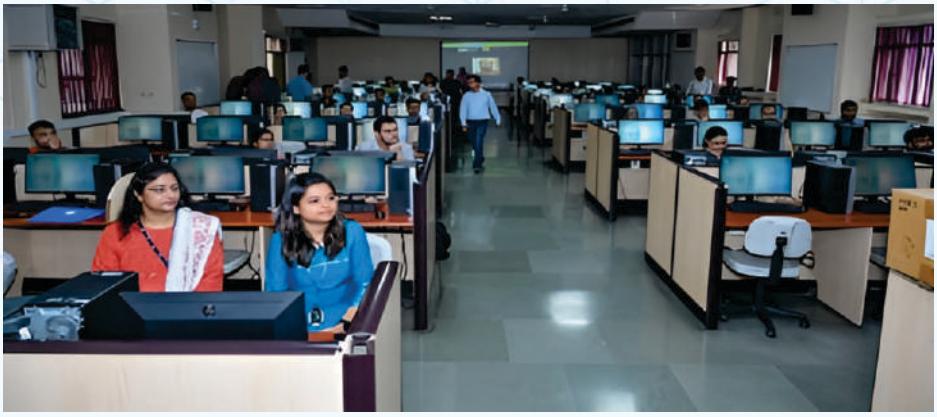
Events / Conferences

1. HPC Training programme for faculties of MAHE, Manipal was conducted during January 4-5, 2024

2. AICTE Master Trainer Program for HPC from C-HUK was conducted at C-DAC Electronic City, Bangalore during February 12-23, 2024

3. Acceleration of Startup Success Workshop was organized in collaboration with NVIDIA for capacity building, promote PARAM Utkarsh usage among MSME and networking with Startup groups at C-DAC Knowledge Park, Bangalore on February 1, 2024

4. HPC software workshop to train the users of PARAM Sanganak and OpenMP, MPI & OpenACC was conducted at IIT Kanpur during July 27-28, 2023



5. HPC software workshop to train the users of PARAM Kamrupa and OpenMP, MPI & OpenACC was conducted at IIT Guwahati on March 2, 2024

6. MANAS Codeathon and Symposium 2023 was organized to sensitize young citizens to code for mental wellness and digitize the IEC materials, ideas etc. at Bangalore during October 6-7, 2023

7. Instruction Enhancement Programme (IEP) for faculty members under C2S Programme was conducted at C-DAC Bangalore during February 12-16, 2024
8. 4th International Conference on Public Key Infrastructure and its Applications (PKIA 2023) was organized in collaboration with CCA at Bangalore during September 8–9, 2023.

9. 2nd International Conference on Internet Research & Engineering (ICIRE) 2023 was organized at New Delhi in collaboration with NIXI during June 7–8, 2023

10. Indian Web Browser Development Challenge (IWBDC) to Spearhead Indigenous Innovation Shaping the Future of Internet was launched at New Delhi in collaboration with MeitY and CCA on August 9, 2023

11. Training programme on ISO 19790 Compliance and Validation Process was organized at C-DAC Bangalore during October 10-12, 2023. Prof. C E VeniMadhavan, Professor (Retd), CSA Department, IISc, delivered a talk on "Design of Post Quantum Cryptographic Algorithms" during the same.

12. FDP Programme on Quantum Technologies was conducted at MAHE, Manipal during February 12-16, 2024
13. Unveiling the IoT Security Roadmap of India for Multi-Stakeholder was organized at C-DAC, Bangalore on December 08, 2023

14. 2nd Stakeholders Meeting on National IoT Security Roadmap was conducted at New Delhi on January 18, 2024

15. As a part of promotional activity of FutureSkills PRIME - Cyber Security, various webinars were conducted on Wireshark and Ransomware Audit, Types of Attacks in the Cyber World, Basic Attacks and Mitigation Techniques, Cybercrimes-Taxonomy and Prevention Strategies, etc. during May to December 2023 in online mode.
16. Industry Meet on Connected Vehicle Technologies for India was organized in collaboration with TiHAN-IITH in order to discuss government perspective on V2X, technology landscape, application uses cases, standards/regulatory frameworks, pilot implementations, challenges & opportunities, C-V2X Roadmap, Collaborations and Consortiums at Hyderabad on November 17, 2023

17. 1st and 2nd Multi Stakeholder Consultation Meetings on Mobile Security Roadmap were conducted at Hyderabad and Gandhinagar respectively on November 29, 2023 and February 20, 2024 in collaboration with MeitY and National Forensic Sciences University.

18. Stakeholders Meet on "ICT and Electronics based indigenous solutions for dairy industry" was conducted at Kolkata in collaboration with ICAR-NDRI ERS, Kalyani and IIT, Kharagpur on September 23, 2023

19. Inauguration Ceremony for Product Design Center Under AgriEnIcs Program was conducted at C-DAC Kolkata on July 10, 2023. GrainEx - a machine vision solution for multi-crop quality analysis was launched during the function.

20. C-DAC in association with the University of Calcutta hosted an International Conference on Systems and Technologies for Smart Agriculture (ICSTA 2023) under the 'AgriEnIcs' programme at Kolkata during December 19-20, 2023. The conference is based on the theme "Cultivation of civilization through sustainable agricultural practices-Together We Make it Possible".

21. Start-up Meet was organized at C-DAC Kolkata in collaboration with IISER Kolkata, Bose Institute, Kolkata and IIT-ISM Dhanbad on July 4, 2023

22. International Symposium on Quantum Computing and Innovations was organized at IIT BHU Campus, Varanasi during July 14-15, 2023
23. Workshop on the "Capacity Building program to enhance the livelihood of Artisans and Weavers of BTC using ICT Tools & Technologies" was conducted at Handloom Training Institute, Mushalpur, Baksa, BTC, Assam during February 8-9, 2024

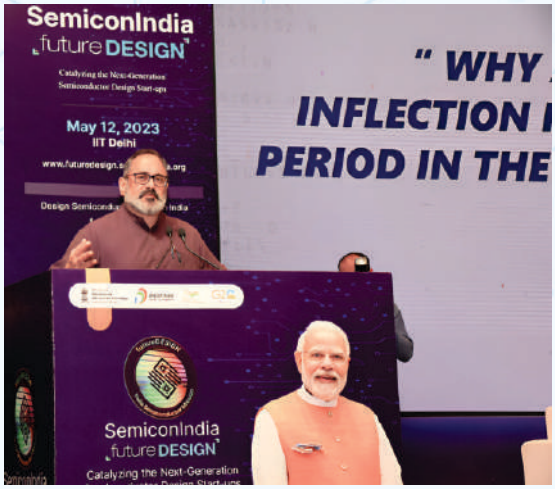
24. Stratagem 2.0 - Unveiling Cyber Forensics R&D Roadmap was organized by C-DAC in collaboration with MeitY at C-DAC Kolkata on January 31, 2024.

25. Training-cum-Workshop on FPO-mediated IT Interventions was conducted at Birsa Agricultural University (BAU), Ranchi on September 11, 2023.

26. To build awareness about various eGovernance products/services of C-DAC, various workshops were conducted at Mumbai, Gandhinagar, Shimla and Lucknow during May 2023 to February 2024
27. Workshop was organized in online mode for Olabs presentation and demonstration to Schools, teachers & students from Odisha Region on May 15, 2023
28. Training of Olabs was organized for the master trainers of the Rajasthan Schools on March 4, 2024

29. 'SemiconIndia 2023' was organized in collaboration with MeitY to make India a global hub for Semiconductor Design, Manufacturing and Technology Development at Gandhinagar, Gujarat during July 28-30, 2023

30. 3rd Semicon India-FutureDESIGN RoadShow was organized in collaboration with MeitY to encourage innovation, facilitate investment and catalyse the Semiconductor Startups ecosystem at IIT Delhi on May 12, 2023



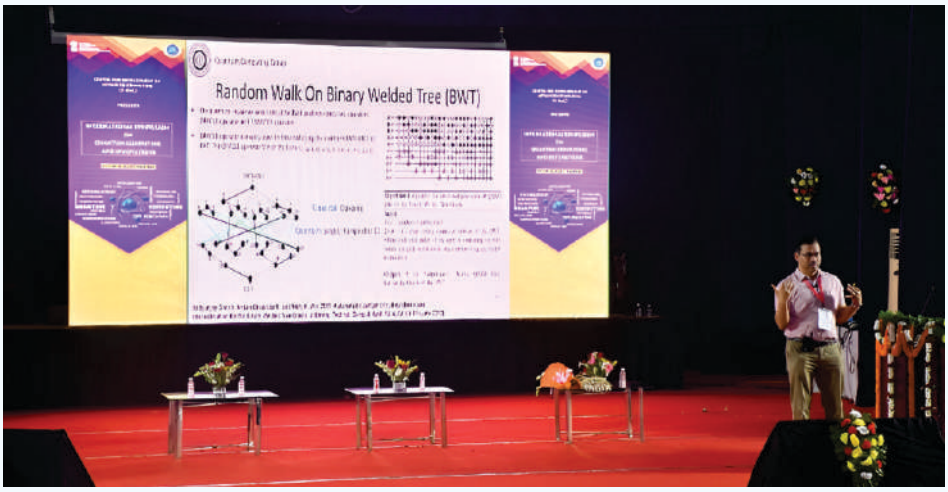
31. Workshop on Common API Platform – Specification related to Application Developers for Certifying Authority and Token Vendors were conducted at C-DAC Noida during July and August 2023.

32. 4th International Conference on Emerging Trends and Technologies on Intelligent Systems (ETTIS-2024) was organized in hybrid mode at C-DAC Noida during March 27-28, 2024 in collaboration with Automatic Control, Computers & Electronics Department, Petroleum-Gas University of Ploiesti, Romania, the University of Haute-Alsace, France, North-eastern University, USA and Springer

33. AICTE sponsored ATAL (AICTE Training and Learning) Faculty Development programme on Remotely Piloted Aircraft System was conducted at C-DAC Noida during January 29 – February 3, 2024

34. PRIME portal for MeitY was launched by Shri Alkesh Kumar Sharma, Secretary MeitY and Shri Bhuvnesh Kumar, Additional Secretary, MeitY on June 19, 2023

35. International Symposium on Quantum Computations and Innovations (ISQCI) 2023 was organized at BHU, Varanasi to foster collaboration, share knowledge, and delve into the latest advancements in quantum technology, particularly in the areas of computing, sensing, strategic needs, and high-performance computing during July 14-15, 2023.



36. International Symposium on Security Engineering for Trusted Cyberspace (ISSETC) – 2024 was organized at Rajgir, Bihar in order to bring together leading experts, researchers, and practitioners in the field of Cyber Security during February 29 – March 01, 2024

37. Workshops on Digital Transformation Technologies were conducted for 1200+ government officials of Bihar including IAS, BAS, Registrar, Sub-Election Officers, and other allied services officials were trained on Advanced Technologies driving Digital Transformation in collaboration with Bihar Institute of Public Administration & Rural Development (BIPARD) during the year.

38. Workshops for MSMEs and Women Entrepreneurs of Dimapur, Aizawl and Agartala was conducted in collaboration with Consumer Unity & Trust Society (CUTS) during November 2023 and February 2024

39. Workshop for training on Cryptography and Network Security for the BEL India was organized to equip BEL officials with cutting-edge insights and practical skills in cybersecurity at Bangalore

40. Cyber Security Awareness Workshop was conducted for 600 students of Army Public School, Patna during October 2023.

41. Workshop on creating a Cyber Safe Ecosystem for 25 officials from the Sashastra Seema Bal (SSB) was conducted at Patna during November 2023.

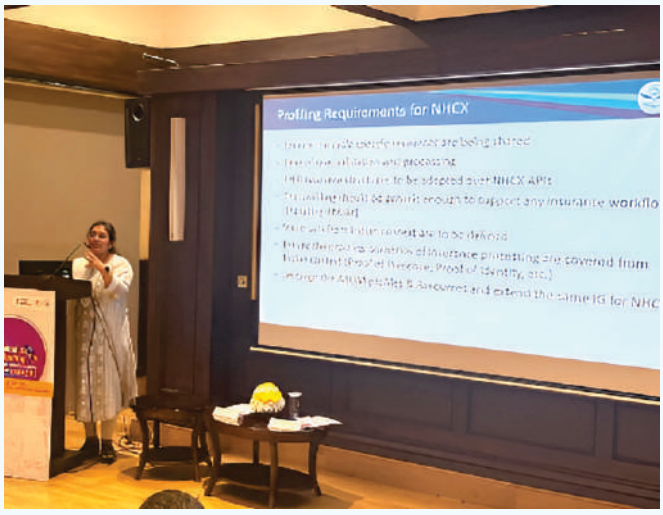
42. 10-day Cyber Crime Investigation Training program for 10 Batches of Bihar Police Officers posted at 44 Cyber Thanas in Bihar was conducted in collaboration with Economic Offences Unit during July 2023 to January 2024.

43. Exascale computing in life sciences in "Accelerating Biology 2024: The Exascale Leap" conference was organized at Pune during February 6 -8, 2024

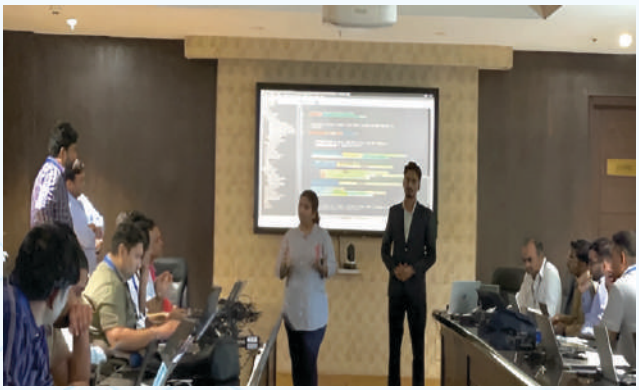
44. 1st Brainstorming Meeting on "Exascale Computing in Life Sciences: Vision and Strategy for India was conducted at C-DAC Pune on July 20, 2023

45. Fast Healthcare Interoperability Resources (FHIR) Meet was organized at C-DAC Pune on May 6, 2023.

46. National Health Claim Exchange (NHCX) – Technical Workshop 2023 was conducted in collaboration with National Health Authority (NHA) at New Delhi on May 29, 2023



47. Webinars were conducted in collaboration with National Health Authority (NHA) for NHCX sandbox, Health Care standards and FHIR implementation in ABDM and NHCX Integration during July 2023 to November 2023



48. Workshop was conducted on 'Healthcare Data Standards and Security' at CMC, Vellore during October 3-4, 2023

49. Webinars were conducted in collaboration with Google Health on building FHIR-based Health Applications with Open Health Stack, building mobile apps with Android FHIR, horizontally scalable analytics on FHIR during November to December, 2023
50. IPR Awareness Program was conducted for unleashing innovation the role of IPR in taking ideas to Market at IIIT - Naya Raipur on November 30, 2023
51. State Level Awareness workshops on MeitY's notified e-Governance Standards & Guidelines under the project e-Governance Standards and Guidelines were organized in collaboration with STQC Directorate, New Delhi at various locations during the year.
52. Workshop and hands-on for knowledge dissemination on Quantum Accelerated Computing was conducted at C-DAC Pune during December 5-6, 2023

53. Workshop on Engineering and Integration Challenges in Quantum Communication and Quantum Computing was conducted at Pune on March 21-22, 2023.

54. National workshop was organized to impart comprehensive training and in-depth understanding of the operational intricacies of the Kanthasth software in collaboration with Department of Official Language (DOL), Ministry of Home Affairs at Delhi during November 28-30, 2023
55. Pre-Conference Tutorials and Workshop on AI/ML Technology for the Geospatial Domain was conducted in collaboration with SIG, IIRS Pune Chapter and ISG Pune Chapter at Symbiosis International (Deemed University), Pune on November 27, 2023
56. ISG (Indian Society of Geomatics) - ISRS (Indian Society of Remote Sensing) Symposium – 2023 was organized at Symbiosis Institute of Geoinformatics, Pune during November 28-30, 2023

57. Hosted Industry meet on "Connected Vehicle Technologies for India" in collaboration with TiHAN IITH at Hyderabad on November 17, 2023
58. As a part of Promotional activity of FutureSkills PRIME- Cyber Security, various online webinars were conducted on Basic Attacks and Mitigation Techniques, Cybercrimes, Taxonomy and Prevention Strategies, etc. during May 2023 to December 2023
59. Brainstorming workshop on "Mission Safe and Secure Cyberspace for the nation- building tools, technologies and Standards: for fostering Collaboration between C-DAC, Industry and academia to build a safe Internet was organized at C-DAC, Thiruvananthapuram on December 22, 2023
60. Webinar was organized for Uttar Pradesh Police to showcase C-DAC's Cyber Forensics Tools on August 9, 2023
61. Hands-on Workshop on DIR-V VEGA Processors to learn about DIR-V VEGA Processors was conducted at Indian Institute of Information Technology (IIIT) Kottayam during February 2 - 3, 2024
62. Hands-on Workshop on DIR-V VEGA Processors to learn about DIR-V VEGA Processors was conducted at IISc Bangalore during January 12 - 15, 2024
63. Nationwide Roadshow on Digital India RISC-V VEGA Processors to promote Digital India initiative and VEGA Processors at 15 locations across India was organized during November 17 - 18, 2023
64. Two-day hands-on workshop on the DIR-V VEGA Processor was hosted by the Department of Computer Science and Automation (CSA) at Indian Institute of Science (IISc), Bangalore during January 13 - 14, 2024.

65. Hon'ble Minister of State (MoS), Shri. Rajeev Chandrasekhar visited C-DAC booth at Indraprastha Institute of Information Technology (IIIT), New Delhi during the Digital India Future Labs Summit held on February 3, 2024.

66. ARIES Development boards featuring Digital India RISC-V (DIR-V) VEGA Processors introduced by Shri Libin T. T. and Shri Haribabu Pasupuleti, Associate Director, C-DAC to Ms. Calista Redmond, CEO, RISC-V International and Prof. Krste Asanovic, Chief Architect, SiFive at the RISC-V Summit in Santa Clara, California held on November 7-8, 2023

67. Shri Alkesh Kumar Sharma IAS, Secretary, Ministry of Electronics and Information Technology (MeitY), Government of India, unveiled the innovative ARIES DOT development board targeted for wearable devices. The event took place in the esteemed presence of Dr. Rathan. U. Kelkar, IAS, Secretary of Electronics and Information Technology for the Government of Kerala, Shri. E. Magesh, Director General, C-DAC and Shri. Kalai Selvan A., Director, C-DAC, Thiruvananthapuram held on August 10, 2023.

68. GCON-VEGATHON organized by IEEE India Council in collaboration with C-DAC (Centre for Development of Advanced Computing) and IIT Guwahati under IEEE Guwhati Sub-section, as a part of IEEE-GCON 2023 during June 23-25, 2023.

Research Papers/Publications

1. Arunachalam, Manavalan and Gopalakrishnan, "Theoretical Exploration of Cluster Nano architectonics: Effects of Doping a Ge13 Cluster with Ta, Fe, Pd, and Co through DFT ", Journal of Electronic Materials, Volume 52, Pages 3018-3028, 2023.
2. Arunachalam, Manavalan and Gopalakrishnan, "Effects of adjacent and opposite doping in Pt11X2 cluster using Ab initio method", Indian Journal of Physics, Volume 97, Pages 2611-2619, 2023
3. David Selvakumar, Mervin, Anurupa Ghosh and Arnab Deb, "SPICE modelling and analysis of hybrid energy harvester combiner topologies", International Journal of Energy Applications and Technologies (IJEAT), Volume 10, Issue 2, Pages 34-48, 2023
4. Jitendra Kumar, Dr. Balaji Rajendran and Dr. S. D. Sudarsan, "Zero-Day Malware Classification and Detection Using Machine Learning", SN Computer Science, Advances in Internet Research and Engineering 2023, Volume 5, Pages 8, 2023
5. Sanjay Adiwal, Balaji Rajendran, Pushparaj Shetty D and Sithu D Sudarsan, "DNS Intrusion Detection (DID)—A SNORT-based solution to detect DNS amplification and DNS tunneling attacks", Franklin Open, Elsevier, Volume 2, Issue 100010, 2023
6. Sanjay Adiwal and Mohammed Misbahuddin, "Intrusion Detection and Prevention in OpenStack: A Case Study on Enhancing Security and Threat Detection", SN Computer Science, Springer Nature, Singapore, Volume 4, Issue 6, Pages 830, 2023
7. S Irene, A John Prakash and V Rhymend Uthariaraj, "Person search over security video surveillance systems using deep learning methods: A review", Image and Vision Computing, Volume 143, Pages 104930, 2024
8. Priyanka Jain, Rohit Kumar Mishra, Aakash Deep and N.K. Jain, "Xplainable AI for deep learning model on PCOD analysis", Elsevier, XAI Based Intelligent Systems for Society 5.0, Pages 131, 2024
9. Kushwaha, Saumya, Priyanka Jain and N. K. Jain, "Deep Learning for Visual Perceptual Brain Decoding as Image Classification", Applied Artificial Intelligence, Taylor & Francis, 2023, Issue 1, Pages 26, 2023
10. S Tatale, N Bhirud, P Jain, A Pahade, D Bagul and N K Jain, "CBT-Driven Chatbot with Seq-to-Seq Model for Indian Languages", AI, IoT, Big Data and Cloud Computing for Industry 4.0, Pages 93–114, 2023
11. P Jain, N Bhirud, S Tatale, A Kale, M Bhale and A Hajare, "Real-time Interactive AR for Cognitive Learning", AI, IoT, Big Data and Cloud Computing for Industry 4.0, Springer, Signals and Communication Technology, Pages 219–239, 2023
12. Bethany Gosala, Pappu Dindayal Kapgate, Priyanka Jain, Rameshwar Nath Chaurasia and Manjari Gupta, "Wavelet transforms for feature engineering in EEG data processing: An application on Schizophrenia", Biomedical Signal Processing and Control, Volume 85, Pages 104811, 2023
13. B.Vijayalakshmi, D. Aneesh, et al., "Vikaspedia-Leveraging Technology for a Digitally Informed and Empowered Bharat", Smart Trends in Computing and Communications. Proceedings of SmartCom 2024, Volume 3, Springer Nature, Pune, India, Pages 160-165, 2024
14. N Satyanarayana, "A Blockchain-based Security Assessment Framework", Transactions on Advanced Communications Technology, Volume 12, Issue 2, Pages 1483-1493, 2023
15. Madhuchhanda Das, Venencia Albert, Samaresh Das, Karma Gurmey Dolma, Tapan Majumdar, Pranjal Jyoti Baruah, Suranjana Chaliha Hazarika, Basumoti Apum and Thandavarayan Ramamurthy, "An integrated FoodNet in North East India: fostering one health approach to fortify public health", BMC Public Health, Volume 24, Pages 451, 2024
16. Kunal Chanda, et al, "An AI-based Interactive and Intelligent Museum Exhibit Based on Attention Analysis", The Indian Journal of Technical Education (IJTE), Volume 12, Issue 1, 2024

17. S. Deb, D. Singh, M. Chakraborty, P.K. Panigrahi and A Khare, "Exact envelope solitons in topological Floquet insulators", Optics Letters, Volume 48, Issue 19, Pages 4997-5000, 2023
18. Arun Jana, Devdulal Ghosh, Subhankar Mukherjee, Alokesh Ghosh, Amitava Akuli, Hena Ray and Nabarun Bhattacharyya, "Oil Fatty Acid Measurement (OFAM) System for Blended Groundnut Oil", Smart Trends in Computing and Communications in Springer, Volume 1, Issue 645, Pages 431–438, 2023
19. Adinath Kate, Shikha Tiwari, Jamna Prasad Gujar, Bharat Modhera, Manoj Kumar Tripathi, Hena Ray, Alokesh Ghosh and Debabandya Mohapatra, "Spotting of Volatile Signatures through GC-MS Analysis of Bacterial and Fungal Infections in Stored Potatoes (Solanum tuberosum L.)", Foods, Issue 12(10):2083, 2023
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21. Nazrana Rafique Wani, Syed Zameer Hussain, Gopinath Bej, Bazila Naseer, Mushtaq Beigh, Ufaq Fayaz, Tamal Dey, Abhra Pal, Amitava Akuli, Alokesh Ghosh, B.S. Dhekale and Fehim J. Wani, "Predicting the optimum harvesting dates for different exotic apple varieties grown under North Western Himalayan regions through acoustic and machine vision techniques", Food Chemistry: X, Volume 19, 2023
22. Nazrana Rafique Wani, Syed Zameer Hussain, Bazila Naseer, Imtiyaz Ahmad Zargar, Mushtaq Beigh, Tahiya Qadri, Gopinath Bej, Ufaq Fayaz, Nageena Nazir, Amitava Akuli and Alokesh Ghosh, "Storage and post-cold storage evaluation of exotic apple varieties harvested at different maturity levels using destructive and non- destructive techniques", Journal of Food Composition and Analysis, Volume 125, 2024
23. Yumnam Kirani Singh, "Generation of Stepped and Combined Twill Weaves", International Journal of Research in Engineering and Science (IJRES), Volume 11, Issue 10, Pages 324-333, 2023
24. Yumnam Kirani Singh, "Generation of Twist Weaves from Right Circulant Matrices", International Journal of Research in Engineering and Science (IJRES), Volume 11, Issue 11, Pages 72-79, 2023
25. Yumnam Kirani Singh, "Generation of Twest weaves from Down Circulant Matrices", International Journal of Research in Engineering and Science (IJRES), Volume 12, Issue 3, Pages 100-108, 2024
26. Jyotsna Dei, Shirsak Mondal, Ayan Biswas, Dhruba Jyoti Sarkar, Soumyadeb Bhattacharyya, Souvik Pal, Subhankar Mukherjee, Subrata Sarkar, Alokesh Ghosh, Vipul Bansal, Rajib Bandhyopadhyay, Basanta Kumar Das and Bijay Kumar Behera, "Cr-Detector: A simple chemosensing system for onsite Cr (VI) detection in water", Plos one, Volume 19, Issue 1, 2024
27. Dhruba Jyoti Sarkar, Saswata Goswami, Swarupananda Sahu, Bijay Kumar Behera, Pranaya Parida, Shyamal Chandra Sukla Das, Basanta Kumar Das, Partha Sarkar, Debabrata Pradhan, Subhankar Mukherjee, Souvik Pal and Vipul Bansal, " An Amperometric Acetylcholinesterase Biosensor Based on Polyvinyl-Alcohol-Capped Silver Nanoparticles (AgNPs@ PVA) for Detection of Organophosphate Pesticides" , ChemistrySelect, Volume 8, Issue 25, 2023
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34. Archana Rane, Sahana Murthy and Sasikumar M., "GaMINLab - Meaningful Gamification to Engage Students in Science Inquiry Practices through Simulation Labs", 31st International Conference on Computers in Education, 2023

35. Mukund Kr Roy, Karunesh Kumar Arora and Sunita Arora, "A novel approach for bootstrapping and automatic transcription of low resourced language speech corpus", Oriental International Committee for the Co-ordination and Standardization of Speech Databases and Assessment Techniques (OCOCOSDA), Delhi, 2023

36. Mukund Kr Roy, Karunesh Kumar Arora and Sunita Arora, "Bidirectional Hindi-Punjabi Machine Translation", International Conference on Natural Language Processing (ICON), Goa, 2023

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38. Uppuladinne, Mallikarjunachari V N, Archana Achalere, Uddhavesh Sonavane and Rajendra Joshi, "Probing the structure of human tRNA 3 Lys in the presence of ligands using docking, MD simulations and MSM analysis", RSC advances, Volume 13, Issue 37, Pages 25778-25796, 2023

39. Dowerah, Dikshita, Mallikarjunachari VN Uppuladinne, Plaban J. Sarma, Nishant Biswakarma, Uddhavesh B. Sonavane, Rajendra R. Joshi, Suvendra K. Ray, Nima D. Namsa, and Ramesh Ch Deka, "Design of LNA Analogues Using a Combined Density Functional Theory and Molecular Dynamics Approach for RNA Therapeutics", ACS Omega, Volume 8, Issue 25, Pages 22382–22405, 2023

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Invited Talks

1. Dr. S. D. Sudarsan, “Generative AI: Opportunities & Challenges”, Workshop on Cyber Security, IAS Officers Association, Infantry Road, Bangalore, February 17, 2024.
2. Dr S. D. Sudarsan, “Securing the Future: Integrating Smart Grid, Metering, and Communication Technologies with Cyber Security”, National Conference on Smart Grid, Smart Meter, Communication Technologies and Cyber Security, CPRI, Bangalore, February 15, 2024.
3. Dr. S. D. Sudarsan, “Driving the “Exascale computing in life sciences”, Accelerating Biology 2024: The Exascale Leap, The Orchid Hotel, Pune, February 6, 2024.
4. Dr. S. D. Sudarsan, “Local Large Language Models for Enterprises”, Karnataka Digital Economy Mission (KDEM), Keonics, Bangalore, January 25, 2024.
5. Dr. S. D. Sudarsan, “VLSI & Quantum Electronics”, 37th International Conference on VLSI Design 2024, ITC Royal Bengal, January 09, 2024.
6. Dr. S. D. Sudarsan, “Resiliency for Digital Enterprises”, NASSCOM DSCI Annual Information Security Summit (AISS) 2023, The Leela Ambience, Gurugram, December 21, 2023.
7. Dr. S. D. Sudarsan, “Privacy “, 19th International Conference on Information and Systems Security, NIT Raipur, December 16, 2023.
8. Dr. S. D. Sudarsan, “Overview of PKC, PKI and PQC & Hands-on Exercises” Indocrypt 2023: Workshop on Quantum Effects on Digital Trust, BITS Pilani, Goa Campus, December 10, 2023.
9. Dr. S. D. Sudarsan, "AI for Bharat" - IEEE Bangalore Technologi Conclave, Hotel Royal Orchid, Bangalore, November 4, 2023.
10. Dr. S. D. Sudarsan, “Mental Wellness & MANAS”, MANAS Codeathon & Symposium on Mental Health & Wellness, VRR Astoria Resort, Bangalore, October 07, 2023.
11. Dr. S. D. Sudarsan, “Quantum Technology Initiatives”, Quantum Technology Conclave 2023, Taj Man Singh, New Delhi, October 5, 2023.
12. Dr. S. D. Sudarsan, “Drone Technology”, Ladakh Education Fair and boot camp on "Drone technology" & IoT Kits, EJM College, Leh & Government Degree College, Kargil, August 24 -25, 2023.
13. Dr. S. D. Sudarsan, “Indigenous Web Browser Development: Insights”, Launch of Indian Web Browser Challenge, India Habitat Centre, Delhi, August 09, 2023.
14. Prachi Pandey, “Automatic Parallelizing Compiler for Open ACC”, NVAITC technical sharing session (global technical forum of NVIDIA), Online, May 3, 2023.
15. Prachi Pandey, “Challenges in Parallel Programming and Automatic Parallelization”, Karyashala (High-end Workshop) on High Performance Computing” in NIT Trichy, May 27, 2023.
16. Deepika H. V., “Introduction to HPC, Parallel programming Overview & Job submission”, Faculty Development Programme (FDP) on High-Performance Computing (HPC) & Artificial Intelligence (AI), Assam Engineering College, Guwahati, July 17, 2023.
17. Deepika H. V., “Overview of HPC and Parallel Programming”, Master Trainer Program for the AICTE C-DAC, Bengaluru, February 12, 2024.
18. Deepika H. V., “Introduction to HPC & Parallel programming Overview”, HPC Software Workshop, IIT, Kanpur, July 27, 2023.
19. Lagineni Mahendra, “IEC 62351 - Securing data communications in smart grid”, Workshop on Cyber security initiatives in the power sector, CPRI, Bengaluru, February 16, 2024.
20. Shrikrishna S. Chippalkatti, “C-DAC’s efforts towards Smart water distribution and Management”, Bentley Innovation Day - Water Infrastructure, The Oberoi, Bengaluru, November 07, 2023.

21. Arnab Deb, "Comprehensive Guide to Navigating the Analog Design Landscape: From PDK Foundations to Layout Optimization with Capless LDO and 10-bits SAR ADC Case Studies", International Conference on VLSI Design, 2024, LSID 2024, Kolkata, January 6, 2024.
22. Ramesh Naidu Laveti, "Research & Innovation in emerging privacy-enhancing technologies (PETs) in the context of AI and Generative AI", Privacy Engineering Summit, DSCI, Bangalore, December 11, 2023.
23. Dr. R. C. Saritha, "MANAS - Mental health", Mental health session to officers of Naval Provost Regulating School, Goa, August 22, 2023.
24. Dr. Ch Janaki, "HPC, Machine learning, and AI for Agriculture", Two days IEEE FDP on "Applications of Digital technologies in Agriculture", Online, Hybrid event organized by SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur, November 29-30, 2023
25. Dr. Ch Janaki, "Data Science in Agriculture", ISTE approved one-week online STTP on 'Research Trends in Data Science', Online program organized by Department of Information Technology, MKSSS's Cummins College of Engineering for Women, Pune, February 27- March 4, 2023.
26. Dr. Ch Janaki, "Artificial Intelligence in Food industry", CSIR's One Week One Lab (OWOL) campaign organized by CSIR-Central Food Technological Research Institute, Mysore, July 3-7, 2023.
27. Dr. R. Balaji, "Amplifying Social Media Outreach - Strategies for Maximum Impact", Doordarshan Kendra, Bangalore, June 19, 2023.
28. Dr. R. Balaji, "DNS Health Index", ICIRE 2023, New Delhi, May 25, 2023.
29. Dr. R. Balaji, "AI for Cyber Security - Towards Resilient Systems", 2nd International Conference - IICI 2023, BEL Academy of Excellence, Bengaluru, May 5, 2023.
30. Dr. Asvija B., "Quantum Communication", Quantum Communication Workshop, RV College of Engineering, Bangalore, February 2, 2024.
31. Ashish Bisht, "MPI Programming", HPC Software Workshop, IIT, Kanpur, July 27,2023
32. Surabhi Dwivedi, "Open API policy for e-Governance applications in India", State Level Awareness Workshop for the State of Karnataka, Bangalore, September 16, 2023.
33. Surabhi Dwivedi, "Responsible AI in education", Harnessing AI in Education - Empowering Educators at Christ University, Bangalore, December 14, 2023
34. Dr. Sanjay Adiwal, "Demystifying DNS Abuses - Tunneling and DDoS Amplification techniques and mitigations", Sixth International Conference on Applied Soft Computing and Communication Networks (ACN'23), PES University Bangalore, India, December 18-20, 2023.
35. Dr. Vishal J. Rathod, "IoT security on embedded devices: implementation and challenges", Workshop on M2M/IoT Security and use cases, Department of Telecom -DoT, Bangalore, June 02, 2023.
36. Harikrishnan V. S., "Advancing Healthcare through Biomedical Imaging: Chest X-Ray Image Analysis", National Workshop on Deep Learning for HealthCare Image Analysis, SRM College of Engineering, November 1-3, 2023.
37. Harikrishnan V. S., "Emerging Image and Video Analytics Applications in Deep Learning Era", International Summer School on Material Informatics and Biophotonics for Medical and Energy Research (INSUMMER) Workshop, Department of Medical Physics, Center for Material informatics, CEG Campus, Anna University, June 5, 2023.
38. Harikrishnan V. S., "AI in Healthcare", DST SERB Sponsored Two-day National Level Seminar "Pioneering Advanced AI Techniques for Revolutionary Medical Imaging Diagnostics", RMD Engineering College, Tamil Nadu, December 1-2 2023.
39. Dr. Priyanka Jain, "Brain Behavioural AI", DD National Morning Show, Tech Innovator, Brain Behavior Computing, October 24, 2023.
40. Dr. Priyanka Jain, "Lier Lier in My brain", Social Neuroscience (Mapping Social Minds: Insights into Brain Function and Social Behavior), A three-day international colloquium on the occasion of 'Brain Awareness Week', NFSU Gandhinagar, Gujarat, March 12, 2024

41. Dr. Priyanka Jain, "Digital Forensic AI", Winter course on cyber law by Indian Society of International Law, ISIL, New Delhi, December 29, 2023
42. Dr. Priyanka Jain, "Simply, it is about AI", Artificial Intelligence Workshop, APJ International School, New Delhi, September 15, 2023.
43. Devadatta Sasmala, "Cyber Security Awareness program for Union Bank of India", Town Hall Meeting, Zonal Office, Union Bank of India, Delhi, March 06, 2024
44. Anurag Rajput, "Guidelines on Information Security Practices for Government Entities", Security Awareness Session, Reserve Bank of India, New Delhi, November 14, 2023
45. T Sai Gopal & Yuvraj Takey, "Malware Analysis", Cyber Security for in-service Defense Ministry officers, C R Rao Advanced Institute of Mathematics, Statistics and Computer Science, C-DAC Hyderabad, November 7, 2023.
46. Santosh Sam Koshy, "IoT Device Life Cycle Monitoring Powered by Blockchain Technology", NCoE Crypto Innovation Series (CIS-25), DSCI, Online, October 23, 2023.
47. Santosh Sam Koshy, "IoT Applications in Agriculture:Need, Case Studies & Challenges", Big Data Analysis for Weather based Crop Management, ICAR-CRIDA, February 9, 2024
48. Dr. S V Srikanth, "An advance IoT initiatives in Agriculture and Allied sectors", Training on Innovative Extension Approaches on Agri ToT and Allied Sectors, EEI, Rajendranagar, Hyderabad, October 3, 2023.
49. Dr. S. V. Srikanth, "Introduction to Internet of Things (IoTs) (2) IoT examples and Case studies", ICTs for Agricultural Extension-New Concepts: IoTs and Artificial Intelligence in Agriculture, MANAGE, Rajendranagar, Hyderabad, January 9, 2024.
50. Dr. S V Srikanth, "Energy Efficient 5G C-V2X", FDP on Green Communication in 5G usecases, CVR Engineering College, Hyderabad, August 21, 2023.
51. Vijayalakshmi B., "Multilingual digital knowledge sharing for societal empowerment", Digital core competencies and skills for effective transfer of technology in Agri and allied sectors, Extension Education Institute, Hyderabad, August 30, 2023.
52. Vijayalakshmi B., "AI-Enabled Digital Knowledge Sharing in Indian Languages – Vikaspedia as a Case", Innovations in Digital Extension, ICAR- National Academy of Agricultural Research Management (ICAR -NAARM), Hyderabad, March 13, 2024.
53. Tapas Saini, "Overview of Artificial Intelligence-Tools, Techniques and applications in Agriculture", ICTs for Agricultural Extension-New Concepts: IoTs and Artificial Intelligence in Agriculture, Online (For MANAGE, Hyderabad), January 8, 2024.
54. Tapas Saini, "Deepfake challenges and Detection", National Security Strategies Conference-2023, New Delhi, August 25, 2023.
55. Tapas Saini, "Developments in Deepfakes Detection", c0c0n-XVI Workshop, Kochi, October 7,, 2023.
56. Indraveni K., "Threat Modeling of Blockchain Applications and Infrastructure", Faculty Development Program, Geethanjali college of engineering and technology, November 16, 2023.
57. Indraveni K., "Security Issues in Cyber Physical Systems", One Week e-STC on Recent Trends in Cyber Physical Systems and Big Data, Online, September 4, 2023.
58. Indraveni K., "Secured Digital transactions and online payments", Annual Tech talks, Teegala Krishna Reddy Engineering College, Meerpet, September 1, 2023.
59. M. Jagadish Babu, "Cyber Safety and Security", 3 Day Training, Defence Institute of Quality Assurance, Bangalore, May 29-31, 2023.
60. M Jagadish Babu, "Cyber Hygiene Practices", Cyber Jaagrookta Diwas (CJD) week, Raebareli Postal Division, June 1, 2023.
61. M. Jagadish Babu, "Cyber Hygiene Practices", Cyber Jaagrookta Diwas (CJD) week, Ghaziabad Postal Division, June 2, 2023.

62. Sadhu Srinivas, "Dark web frauds and Security measures", Cyber Jaagrookta Diwas (CJD), Online, June 7, 2023.
63. M Jagadish Babu, "Cyber Hygiene Practices", Cyber Jaagrookta Diwas (CJD), Southern region of Extension Education Institute, Hyderabad, June 8, 2023
64. Dr. Devadatta Sasmala, "Cyber Hygiene Practices", Ministry of Ayush, GoI, June 9, 2023
65. M Jagadish Babu, "Cyber Hygiene Practices", Vartalap, Journalists of Nagurkurnool district of Telangana, July 19, 2023
66. Indraveni K., "Cyber Hygiene Practices", 73rd ESIC Foundation Day, ESI Hospitals, February 8, 2024.
67. M Jagadish Babu, "Cyber Hygiene Practices", Consumer outreach Program by TRAI, Hyderabad region, Visvesvaraya College of Engineering & Technology, Ibrahimpatnam, Rangareddy District, Telangana, February 29, 2024.
68. M. Kumar, "Mobile Apps in Agriculture and Agricultural Marketing", Online training programme on "ICTs in Agricultural Marketing and Block Chain Technologies for FPOs", Online, September 22, 2023
69. M. Kumar, "Mobile Apps – Evolution", Online Training Program on Recording and Editing in Mobile Apps for Extension Professionals, MANAGE, Hyderabad, October 16, 2023
70. M. Kumar, "C-DAC Initiatives in Emerging Technologies", C-DAC Tech Talks 2023, Hyderabad Institute of Technology and Management (HITAM), December 18, 2023.
71. M. Kumar, "Mobile App development for Drone Applications in Agriculture", Five-day training programme on "Drones for Agricultural Development" for officers of Agriculture department, Odisha Government, MANAGE, Hyderabad, December 19, 2023.
72. Mina H. K. Desai, "India Enterprise Architecture", State Level Workshop on e-governance Standards and Guidelines, Patna, November 6-7, 2023
73. Dr. Subimal Deb, "Variations of self-imaging distance in wave guide", QIQT 2023, Kolkata, May 12, 2023.
74. Sourav Mitra, "Identification of Social Media frauds and Security measure", Cyber Jaagrookta (Awareness) Diwas by MeitY, Online, April 5, 2023.
75. Asok Bandyopadhyay, "Introduction to Cyber Security and need of Cyber Security", Training on Operation & Maintenance, Exhibit Development for Science Centres / Innovation Hubs, NCSM, Kolkata, August 11, 2023.
76. Sangam Kumar Chaturvedi, "Cybersecurity with Live Demonstration on Security Attacks", Cyber security Workshop, SSN College of Engineering, Kalavakkam, August 17, 2023
77. Sangam Kumar Chaturvedi, "Cyber Security in web applications", Cyber Security and Cloud Computing, AarupadaiVeedu Institute of Technology (AVIT), September 6, 2023.
78. Sourav Mitra, "Use of Social Media, Tracing Absconder and Collection of Intelligence", Awareness program for the rank of SI to ASP of CBI, CBI, RTC, Kolkata, September 20, 2023.
79. Sourav Mitra, "Cyber Security", Awareness program for the faculty and students of University of Calcutta, Raja Bazar Science College, Kolkata, October 12, 2023
80. Sourav Mitra, "Cyber Security", Awareness program for the members of National Jute Board, Hotel Hindusthan International, Kolkata, October 31, 2023
81. Sangam Kumar Chaturvedi, "Career in Cyber Security and live demo on ethical hacking", Awareness program for the students of Dr MGR University, Online, November 30, 2023.
82. Bibekananda Kundu, "Natural Language Processing Applications, Challenges and Techniques", A.K. Choudhury Centenary Memorial Workshop, Institute of Radio Physics and Electronics, Kolkata, December 13, 2023.
83. Asok Bandyopadhyay, "Contribution in the area of IT and electronics towards the creation of a future India", 3rd International Conference on Advanced Computing and Applications (ICACA-2024), Techno India Main Salt Lake, Kolkata, February 23-24, 2024
84. Kunal Chanda, "Deepfake Detection Technologies", Audio-Video-image Authentication, CFSL Kolkata, May 22, 2023

85. Dr. Joyanta Basu, "Machine Learning using Python Programming & Weka Tool", National Workshop on Emerging Tools and Technologies in Research (ETTR-2023), Department of Information, Technology, Tripura University (A Central University), Agartala, November 22, 2023
86. Ritesh Mukherjee and Sonali Dhali Mustafi, Image Processing: Information Hiding using steganography as case study on 1. Image Processing & Computer Vision and 2. Steganography & Steganalysis: An Initiative by C-DAC, Kolkata, West Bengal State Centre, The Institution of Engineers (India), Webinar under the aegis of the Electronics & Telecommunication Engineering Division Board, Kolkata, June 17, 2023
87. Dr. Subhankar Mukherjee, "Opportunities of Startups in Agriculture and Environmental Sector", Exploring the nanoscale: synthesis and characterization & Microfabrication using mask-based and maskless lithography for different biological applications, School of Biotechnology (SBT), Jawaharlal Nehru University (JNU), New Delhi, February 18-19, 2024
88. Dr. Amitava Akuli, "Electronic Quality Assaying Solutions for Agricultural Marketing", Knowledge Sharing & Brainstorming Session on "Technological Advancements and Reforms in Agricultural Marketing", SKUAST-Kashmir, Srinagar, December 22-23, 2023
89. Dr. Hena Ray, "Robotics", (DST) SERB-sponsored "a Karyashala, High-end workshop on Internet-of-thing (IoT) and Artificial Intelligence (AI) and its Industrial Applications", CSIR-CMERI Durgapur, June 27, 2023
90. Dr. Hena Ray, "Robotics", IEEE R10 Young Professionals UpSkill 2023, IIT, Kharagpur, July 15 2023
91. Devdulal Ghosh, "IoT and its application in fisheries", Online Training Programme on "Digital Technologies for the Transformation of Aqua Farming in India", National Institute of Agricultural Extension Management, Hyderabad & Tamil Nadu, Dr. J. Jayalalithaa Fisheries University, Dr. M.G.R. Fisheries College & Research Institute, Ponneri, Tamil Nadu, August 23-25, 2023.
92. Sangit Saha, "Internet of Things in Agriculture and Allied Sector", Webinar on "Role of Internet of Things (IoTs) in Agriculture and Allied Sector" at National Institute of Agricultural Extension Management, Online, September 8, 2023
93. Dr. Sanjay Sood, "Digital Health", Shinghai Cooperation Organization (SCO), Online, May 12, 2023.
94. Dr. Sanjay Sood, "eSanjeevani", Indo - Pacific Island member states workshop on Digital Public Goods, Online, December 11, 2023
95. Dr. Sanjay Sood, "Needs assessment study (applications of telemedicine during disaster recovery and natural calamities)", Triangular Development Programme (TriDeP) project, Fiji, July 1-14, 2023
96. Sonia Dosanjh, "Women and IP: Accelerating Innovation and Creativity", Commemoration of World IP Day-2023, Punjab University, Chandigarh, April 26,2023.
97. Chetan Manchanda, "Support for startups, industry Collaboration", Transform 8.0 by Punjab Angels Network, Chandigarh, September 02, 2023.
98. Chetan Manchanda, "Building an Invention into a Business", One day workshop on "Idea to Market- The IPR Journey", Punjab University, Chandigarh, December 19, 2023
99. Sanjay Madan, "Machine Learning in Cyber Security", Recent Developments in Machine Learning and its applications, IIIT Una, June 05 2023.
100. Nirmala Salam, "Privacy and Trust in Blockchain" and "Use Cases of Blockchain", Capacity Building Program on "Blockchain: Future of Cybersecurity" organized by Sardar Patel Institute of Technology in collaboration with Dwarkadas J. Sanghvi College of Engineering and M.H. Saboo Siddik College of Engineering in association with IEEE Bombay Section Educational Activities, Mumbai, July 07, 2023.
101. Suman Ninoriya and Priyanka Monde, "Virtual Labs on DIKSHA: Concept, Purpose, Type, Development, and Dissemination Process", Orientation of State Resource Groups (SRGs) on Development of eContent for Diksha, Online, October 11, 2023
102. Suman Ninoriya and Priyanka Monde, "Virtual Labs on DIKSHA: Concept, Purpose, Type, Development, and Dissemination Process", Orientation of State Resource Groups (SRGs) on Development of eContent for Diksha, Online, October 18, 2023.

103. Archana Sharma and Priyanka Monde, "Virtual Labs on DIKSHA: Concept, Purpose, Type, Development, and Dissemination Process", Orientation of State Resource Groups (SRGs) on Development of eContent for Diksha, Online, November 1, 2023.
104. Vaibhav Singh and Priyanka Monde, "Virtual Labs on DIKSHA: Concept, Purpose, Type, Development, and Dissemination Process", Orientation of State Resource Groups (SRGs) on Development of eContent for Diksha, Online, November 8, 2023.
105. Jitendra Singh, Shamshad Ansari and Partha P. Chattaraj, "Medical Logistics and Supply Chain Management", 2023 Conference at AH (R & R), AFMSD Delhi, November 9, 2023
106. Amarjeet Singh Cheema, "Council for building a Cyber Resilient India", Trellix Cyber Sabha, Delhi, April 23, 2023
107. Amarjeet Singh Cheema, "How to use OPD doctor desk", AIIMS Bhawan Bahadur Nagar, Bhawan Bahadur Nagar, May 18, 2023
108. Amarjeet Singh Cheema, "Need of Open-Source Collaboration for Digital Transformation in Healthcare", IIT Jodhpur, Jodhpur, October 28, 2023
109. Amarjeet Singh Cheema, "Implementation Challenges in Digital Transformation in Healthcare", Innohealth @ IIIT Delhi, IIIT Delhi, December 15, 2023.
110. Rekha Saraswat, "Understanding Cyber Health", IPU Health Mela, Talkatora Stadium, New Delhi, October 12, 2023
111. Dr. Arti Noor, "Importance of Data protection and online security", 'Leading Cyber Security Change - Building A Security Based Culture' in ITEC training programme", Amity University, Noida, March 2, 2023
112. Dr. Arti Noor, "Innovation in Emerging Technologies for Sustainable Development: C-DAC Role", International Conference on Sustainable Emerging Innovations in Engineering and Technology (ICSEIET-23) on September 14-15, 2023, Sponsored by IEEE, ABES Engineering College Ghaziabad, September 14, 2023
113. Dr. Arti Noor, "Browser security and open-source tools", Cybersecurity Training: Navigating the Digital Landscape, Lok Sabha Secretariat, New Delhi, October 5, 2023.
114. Dr. Lakshmi Kalyani, "Emerging technologies for Healthcare", National Conference on Clinical Nursing Research: Collaborative Excellence, AIIMS, Delhi, October 25, 2023
115. Dr. Kalpana Johari, "Application of Robot Operating System (ROS2 humble) in UAS", Bootcamp organized by NIT Kurukshetra on Applications of drone in mapping, Online, October 30, 2023
116. Amarjeet Sharma, "Significance of AI and ChatGPT", Workshop on Artificial Intelligence (AI), ChatGPT, and their Impact on Daily Life organized by Bihar Industry Association (BIA), Patna, Date – July 31, 2023
117. Saket Kumar Jha and Sonal Kamal, "Significance of Cyber Security in Industries", Workshop on Cyber Security organized by Bihar Chamber of Commerce", Patna, April 05, 2023.
118. Aditya Kumar Sinha, "Innovation for a Tech-Driven Future", Workshop on National Startup Day, BIA, Patna, January 16, 2024
119. Aditya Kumar Sinha, "Data Enlightenment and Philosophical Landscape of Contemporary Analytics", 8th International Conference on Data Management, Analytics, and Innovation (ICDMAI 2024), Vellore Institute of Technology, Vellore, January 20, 2024.
120. Aditya Kumar Sinha, "Digital Humanity for Future Intelligence", Australia-India Cybersecurity International Symposium, New Delhi, October 30, 2023.
121. Dr. Manoj K. Khare, "HPC Applications for Grand Challenge Problems", 7th Meeting of the BRICS Working Group on ICT and HPC, Shanghai, China, July 9, 2023
122. Dr. Manoj K. Khare, "Geospatial Solutions for Disaster Management", Disaster Responsive Humanitarian Logistics 2023 (DREHL-2023) by NIT Calicut, Online, July 2, 2023.
123. Dr. Manoj K. Khare, "C-DAC's Initiatives on Pilot GLOF EWS for Sikkim", Climate Change Adaptation & Disaster Risk Reduction for Resilient Future, Raghunandan Singh Tolia Uttarakhand Academy of Administration, Nainital, November 6, 2023.

124. Dr. Manoj K. Khare, "Role of GIS and Remote Sensing in Agriculture", Climate Change Adaptation & Disaster Risk Reduction for Resilient Future organized by State Agricultural Management & Extension Training Institute (SAMETI), West Bengal, Online, November 7, 2023.
125. Dr. Manoj K. Khare, "Applications of geospatial technology in Civil Engineering", International Conference on 'Innovations in Mechanical and Civil Engineering, (i-MACE 2023), "Green and Smart Systems", Pimpri Chinchwad College of Engineering, Pune, August 18, 2023.
126. Dr. Manoj K. Khare, "HPC Based Geospatial Solutions for Disaster Management", ISG ISRS National Symposium 2023, Symbiosis Institute of Geoinformatics, Symbiosis International (Deemed University), Lavale Campus, Pune, November 28, 2023.
127. Dr. Manoj Chavan, "Advanced Applications of GIS", A State Level Geo-Fest 2024 organised by Department of Geography, S. P. College, Pune, Lady Ramabai Hall, S. P. College, Pune, January 16, 2024.
128. Dr. Manish P. Kale, "Geospatial Strategy for Forestry & Environment Sector", GeoSmart India, Hyderabad, October 17-19, 2023.
129. Dr. Binay Kumar, "Monitoring of Glacial Lakes in the Himalayan Region GLOF Early Warning System", Webinar organized by National Institute of Disaster Management (NIDM), Webinar on 'Use of Space Technology in GLOFs', April 28, 2023.
130. Dr. Binay Kumar, "C-DAC Solution on Springs and Water Budgeting", Meeting Presentation at Central Ground Water Board (CGWB), Faridabad, CGWB HQ, Faridabad, May 23, 2023.
131. Dr. Binay Kumar, "C-DAC's solution on GLOF Early Warning System", NDMA's pilot GLOF EWS installation at Sikkim, Gangtok, Sikkim, September 08, 2023.
132. Sivakumar V, Kedar Nagnathrao Ghogale and Shankar N. Rathod Karamtoth, "Geo-AI R&D for PMGSY National GIS", Pre-symposium Tutorial and workshop on AI/ML technology and its applications in Geospatial domain & OGC, Symbiosis International (Deemed University), Lavale Campus, Pune, November 27, 2023.
133. Kedar N. Ghogale, "Application of AI in Remote Sensing", MSc. (Geo-informatics) Students, Symbiosis Institute of Geo-informatics, Pune, September 9, 2023
134. Kedar N. Ghogale, "Deep Learning for Remote Sensing Data", Faculty Development Programme, Symbiosis Institute of Geo-informatics, Pune, June 14, 2023.
135. Sajeevan G., "Geospatial Strategy for the Rural Development and Land Administration Sector", National Mapping symposium under GeoSmart India 2023, HICC Hyderabad, October 18, 2023.
136. Sajeevan G., "Application of Remote Sensing and Geographical Information System in Human Welfare", National Science Day 2024 – Event at Pune University", Savitribai Phule Pune University (SPPU), February 28, 2024
137. Sajeevan G., "Drones in Advancement of Geospatial Technology", GeoVision 2023 organized by the Indian Society of Geomatics - Pune Chapter, Indian Society of Remote Sensing, Pune Chapter, Centre for Development of Advanced Computing – Pune, and Symbiosis Institute of Geoinformatics – Pune, Symbiosis Institute of Geoinformatics, Pune, July 7, 2023.
138. Dr. Yogesh Kumar Singh, "Advances in Geospatial Techniques for Disaster mitigation", Disaster Management Support Capacity Building Programme, Motilal Nehru National Institute of technology, Allahabad, Prayagraj, UP, October 31, 2023.
139. Amit Saxena, "High Performance Computing", 2nd IEEE International Conference on "Trends in Quantum Computing & Emerging Business Technologies", Online, March 21, 2024.
140. Amit Saxena, "Quantum Computing", International Symposium on Quantum Computing and Innovations ISQCI 2023, IIT BHU Campus, Varanasi, July 14-15, 2023.
141. Amit Saxena, "Quantum Computing", Workshop in Quantum Accelerated Computing, C-DAC Pune, December 5-6, 2023.
142. Dr. Anindita Banerjee, "Standardization in Quantum Communication", Second International Quantum Communication Conclave, DoT, Delhi, February 15-16, 2024.

143. Dr. Anindita Banerjee, “Aerial Quantum Communication”, "Engineering and Integration Challenges in Quantum Communication and Quantum Computing", Pune, March 21-22, 2024.
144. Dr. Anindita Banerjee, “Quantum Leap”, The India Space Congress, Delhi, July 10-12, 2023.
145. Dr. Anindita Banerjee, “Quantum and Space”, National Quantum Science and Technology Symposium, Delhi, December 14, 2023.
146. Dr. Anindita Banerjee, “Non-terrestrial quantum communication and its impact on cyber security”, Nasscom Annual Technology Conference, Delhi, August 21-22, 2023.
147. Dr. Ganesh Karajkhede, “Ayurinformatics: Understanding Ayurveda through the lens of Modern Science, Ayur informatics workshop, Centre for Complimentary and Integrative Health, Savitribai Phule Pune University, November 20, 2023.
148. Dr. Ganesh Karajkhede, “Role of AyuSoft in Integrative Dietetics Based Diet Planning for Special Conditions”, Value added course for Ayurveda students, College of Ayurved & Research Centre, Sector No. 25, Pradhikaran, Nigdi, Pune, March 16, 2024.
149. Vinod Jani, “NSM Workshop”, Molecular dynamics simulations and tool, NUST, Namibia, July 10-13 2023
150. Dr. Suresh Sharma, “Implementation of EHR standards in Nursing Education and Clinical Practice”, TNAI State Conference 2023, The Great Hall of Hotel Fidalgo, Panjim, Goa, May 13-14, 2023.
151. Manisha Mantri, “Data Storage and Ingestion (Applicable Standards)”, The Executive Program in Digital Transformation of Healthcare Systems - Managing Digital and Connected Health, Indian Institute of Health Management Research (IIHMR) Bangalore, Virtual, June 07, 2023.
152. Manisha Mantri, “New Healthcare Delivery Channels”, Healthcare 360 Degree Summit 2023, Aditya Birla Memorial Hospital Auditorium, Pune, October 13, 2023.
153. Manisha Mantri, “Ayushman Bharat Digital Mission (ABDM) - Translating India’s Digital Health Blueprint into Practice”, Asia eHealth Network (AeHIN) General Meeting and Conference 2023, Jakarta, Indonesia, November 07, 2023
154. Gaur Sunder & Shailendra Singh Narwariya, “Building A Telehealth Technical Standard”, Telemedicon 2023, Goa, November 03, 2023.
155. Gaur Sunder and Manisha Mantri, “India's Roadmap to Digital Health Standards and Patient Safety”, Patient Safety Conclave 2024”, Jupiter Hospital, Thane, January 13, 2024.
156. Dr. Sunitha Manjari K., “Overview of Bioinformatics”, Training on High Performance Computing at Namibia University of Science and Technology Organized under India Namibia CoEIT, Online, July 10, 2023
157. Dr. Sucheta Patil, “File formats (Genomics), RNA-Seq overview”, Training on High Performance Computing at Namibia University of Science and Technology Organized under India Namibia CoEIT, Online, July 11, 2023.
158. Dr. Archana Achalere, “Fundamentals of Statistics for Biological Data analysis”, Training on High Performance Computing at Namibia University of Science and Technology Organized under India Namibia CoEIT, Online, July 11, 2023
159. Ruma Banerjee, “Exome/reference Mapping/ /Variant Calling, de novo mapping, RNA-seq”, Training on High Performance Computing at Namibia University of Science and Technology Organized under India Namibia CoEIT, Online, July 11, 2023
160. Dr. Sunitha Manjari K., “Bioinformatics@C-DAC”, Accelerating Biology 2024: the Exascale Leap

    Hotel Orchid, Pune, February 07, 2024
161. Dr. Sunitha Manjari K., “Role of HPC in Accelerating Biology”, HPC Research Week organised by IIT-Madras and C-DAC NSM-HRD, Online, November 23, 2023
162. Dr. Uddhavesh Sonavane, “Overview of Ayurinformatics activities @C-DAC”, Workshop on Ayurinformatics, Bioinformatics Centre, SP Pune University, November 20, 2023
163. Dr. Uddhavesh Sonavane, “Introduction of Molecular Dynamics”, Workshop on Ayurinformatics, Bioinformatics Centre, SP Pune University, November 25, 2023

164. Dr. Uddhavesh Sonavane, "Introduction of Molecular Dynamics", PhD course work, Bioinformatics Centre, SPPU, Pune, April 25-28, 2023
165. Yengkhom Ranjan Singh, "Assam Technology sector - Opportunities & Software Development from NE Region", 7th edition of Emerging North East 2024, NEDFI Convention, Guwahati, Assam, February 21, 2024
166. Md Farukh Abudin and Manas Rajbongshi, "Career Opportunities in PCB Designing", Career Opportunities IOT, Career Opportunities in Hardware and Electronic, Online Webinar on Career Opportunities, Online, January 17 2024, February 2, 2024 and March 15, 2024.
167. Jitesh Choudhary, "Assam Technology sector - Opportunities & Software Development from NE Region", Intellectual Property Strategies for Technology Commercialization, Assam Start Up, Guwahati, Assam, January 30, 2024.
168. Raja Singh B., "Emergency Response Support System", Freedom Fest 2023 Organized by Government of Kerala, Kerala State IT Mission, Government of Kerala, August 14, 2023.
169. Lijo Thomas, "Advanced Technologies in Road Safety", Sustainable Investing and Responsible Development of Indian Highways Infrastructure, Hotel Le Meridien, New Delhi, December 20,2023
170. Benoygopal E. B., "Adoption of oneM2M in ITS domain", oneM2M Global Seminar Virtual (Global IoT Testing & Certification Center (TTA Pankyo), June 13, 2023
171. Benoygopal E. B., "Role of technology in improving road safety enforcement mechanism", SAFE annual convention 2023, Hotel Taj Guwahati, Guwahati Assam, September 26 -27, 2023
172. Prakash. R., "Leveraging ITS TECHNOLOGIES for CAVS-Next Gen Sustainable Automotive Technologies", Symposium and exhibition -Amrita School of Engineering, Amritapuri Campus, December 7, 2023
173. Prakash. R., "Smart Traffic signal control, Connected and autonomous vehicle (CAV) technologies and E-Mobility", National Seminar on "Smart Cities: An Interdisciplinary Approach", Hotel South Park, Trivandrum, February 16, 2024
174. Senthilkumar K. B., "Cyber Security Attacks & Zero Trust Technology", Emerging Technologies workshop by NIC, Hotel Prasanth, Trivandrum, December 1, 2023
175. Senthilkumar K. B., "Safer Internet Day", Samoohyapadam, Live Phone in program, Doordashan, February 6, 2024
176. Dr. Dittin Andrews, "Cyber Security Current Trends and Opportunities", National Cyber Security Awareness Month 2023, National Centre for Earth Science Studies, Ministry of Earth Sciences, Government of India, October 31, 2023
177. Dr. Dittin Andrews, "Cyber Security Attacks Targeting Healthcare and New Security Paradigm", International Conclave on Advances in Radiology & Radiotherapy – 2023 (iCARE2023), IIT Mumbai, May 16, 2023.
178. Dr. Dittin Andrews, "New Cyber Security Paradigm: From SOC/MSSP Perspective", Freedom Fest 2023 Organized by Government of Kerala, Tagore Theatre, Thiruvananthapuram, August 14, 2023
179. Dr. Dittin Andrews, "Data Privacy concerns for India Organizations in the context of DPDP Act 2023", Workshop of Digital Forensics organized by MBCET Thiruvananthapuram, Online, February 20, 2024
180. Satheesh Kumar S., "Communication device-based cybercrime investigation with a case study to IP, Website and Email investigation", Workshop for Police officers, Police Training College, Thiruvananthapuram, August 22, 2023
181. Dija S., "Proactive and Reactive Cyber Forensics", National Symposium on 'Advancing Digital Forensics and Collaboration to Combat Cyber Crime', Directorate of Forensic Science (DFS), Meghalaya, December 19, 2023
182. Dija S., "Defining the Boundaries: Police vs Laboratory Cyber Forensics", National Symposium on 'Advancing Digital Forensics and Collaboration to Combat Cyber Crime'-Directorate of Forensic Science (DFS), Meghalaya, December 20, 2023
183. Dija S., "Cyber Forensics: Emerging Areas & Challenges", Webinar on Cyber Security, Capgemini October 19, 2023.

Product, Service and Outreach Initiatives

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

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 services 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 used for the purpose are as below -

- Collaborative Innovation Model
- Transfer of Technology
- Engagement with Marketing Consulting Agencies
- Product and Services Sales through GEM

This has resulted in added impetus to business activities.

Collaborative Innovation Model

A model of Intent of Association (IoA) for Collaborative Innovation with private entities including startups which are enabling to take our research output to the market after suitably finishing the product as per the market demands has been introduced.

In the past year, C-DAC has successfully collaborated with

- Aheesa Digital Innovation Pvt. Ltd. for Network Forensics & CDAC Edge box for DARPAN Virtual Network Solution (VNS)
- VVDN Technologies for AMD based Rudra Server Development.

Transfer of Technologies

Science and Technology 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

- Enhanced Version (TraMM-EnV),
- C-DAC Urban Traffic Control Equipment (CUTE),
- Adaptive Traffic Control System Software Composite Signal Control Strategy - Enhanced Version (CoSiCoSt-EnV),
- General Purpose Thermal Camera, Thermal Vision sensor for Road Traffic application - TvITS, SMARTFARM System

Engagement with Marketing Consulting Agencies

In order to enhance the commercial footprint of C-DAC by way of increased deployment/sale/outreach of its products/ solutions/ services/ technologies categorized under various thematic areas C-DAC centers are exploring sale of their products and technologies through Deloitte Touche Tohmatsu India LLP, Mahindra Defense Systems Limited, RailTel Corporation of India Limited and increase reach out.

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 71 products and services on GeM platform and achieved a business turnover of INR 300 Lakhs. Some of the products published are C-DAC SIEM (Security Incident and Event Management Software), Secure BOSS Linux OS and associated software's, Ultrasonic Solid Propellent Burn Rate Measurement System, e-Pramaan (SSO with password, OTP, Digital Signature, Biometric), IOT Research Lab Kits, USB Pratirodh, VAPT Audit Services, Annadarpan (Rice Grain Analyzer), PRAN V2, True Imager, AivaBOT(AI conversation platform), ARIES IoT V2.0,V3.0, MeghSikshak (E-Learning platform), Revival (Backup and Recovery Software), Aadhar Multifactor Authentication System, E-Hastakshar (e-Sign services), COPS SCADA Lab Kit, Indigenized EMLOG System for Submarines, Meghdoot Cloud Suite, Interface Board for Raspberry Pi, Portable Autonomous Surface Vessel, Aadhar Data Vault.

Other Activities

PS&O team is also undertaking appreciable efforts for capacity building through our ACTS training initiative pan C-DAC in niche domains.

C-DAC participated in G20- DIA Mega Summit in Bangalore, G20 Summit in New Delhi, India Mobile Congress (IMC),Bengaluru Tech Summit, Global Partnership on Artificial Intelligence (GPAI) Annual Summit, International Conference on Systems & Technologies for Smart Agriculture, GATEC International Purple Fest, Vibrant Gujarat Global Trade Show and Summit, India International Science Festival, Indian National Exhibition Cum – Fair, International Purple Fest 2024, Goa, India Space Congress 2024, New Delhi, National Startup Day to name a few for exhibiting state of the art technologies and products.

Engagement thro' Social Media

NEWS of the day is broadcasted to all C-DAC members on regular basis. LinkedIn, Twitter, Koo, Facebook, YouTube are increasingly used to disseminate various events and technology developments.

Human Resource Development

The Human Resource Development (HRD) department at the Centre for Development of Advanced Computing (C-DAC) plays a pivotal role in the organization's growth and success. As a premier R&D organization under the Ministry of Electronics and Information Technology (MeitY), C-DAC is at the forefront of developing advanced computing and software technologies. The HRD department ensures that the organization's workforce remains skilled, motivated, and aligned with the strategic goals of the institution.

Importance of HRD in C-DAC

HRD is crucial to C-DAC for several reasons:

1. **Talent Acquisition and Retention:** C-DAC's success depends on its ability to attract and retain top talent in the fields of computing, electronics, and information technology. The HRD department is responsible for recruiting skilled professionals and creating an environment that encourages long-term commitment to the organization.

2. **Skill Development and Training:** Given the rapid pace of technological advancements, continuous learning is essential. HRD facilitates ongoing training and development programs, ensuring that employees remain at the cutting edge of technology and innovation.

3. **Employee Engagement and Well-being:** A motivated workforce is key to organizational success. HRD plays a crucial role in fostering a positive work environment, promoting employee engagement, and ensuring the well-being of all staff members.

4. **Organizational Culture and Leadership:** HRD is instrumental in shaping the culture at C-DAC. By developing leadership programs and promoting a culture of innovation, collaboration, and ethical practices, HRD helps maintain C-DAC's reputation as a leader in the industry.

Key Initiatives Taken by HRD in C-DAC

Throughout the past year, HRD at C-DAC has undertaken several key initiatives aimed at enhancing the skills, engagement, and well-being of the workforce. As the workforce in C-DAC comprises of contractual employees, majority of the initiatives were related to the contractual employees in the financial year. These initiatives include:

1. **Streamlining of procedure for recruitment of manpower from Institutes, falling under Top 50 NIRF Ranking.:**
   - An Office Memorandum has been issued to streamline the recruitment process for manpower from institutes ranked within the Top 50 of the NIRF. This memorandum grants increased authority to Centre Heads for the recruitment of contract employees on a consolidated pay basis, enabling quicker and higher-quality hiring for research-related roles.
2. **Streamlining and proper guidelines for reimbursement of medical expenses of employees on contract on consolidated pay:**
   - In response to the current needs and to provide clarity on the reimbursement of medical expenses for employees on contract with consolidated pay, an Office Memorandum has been issued to establish clear guidelines for this process
3. **Technology Integration in HR Processes:**
   - HRD adopted a new Recruitment Automation System (RAS) to streamline processes such as recruitment and selection, improving efficiency and reducing administrative delay.
   - Online learning platforms were integrated with the HRMS, providing employees with easy access to training materials and resources.

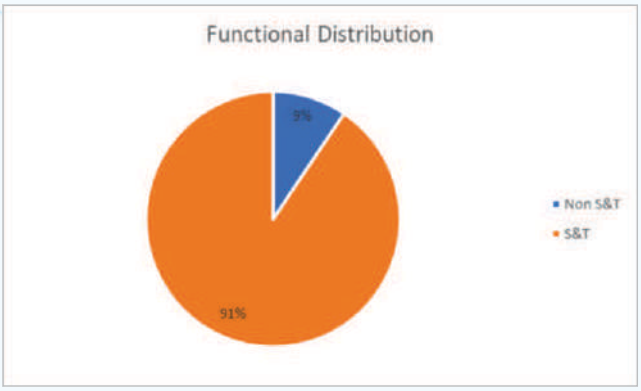
4. **Employee Engagement Activity:**

   o Brian Vita Quiz Contest was introduced for inter-centre Quiz Competition with an intention to increase the general knowledge/current affairs quotient in employees, among various employee engagement initiative for employees wellbeing.

Distribution of Manpower

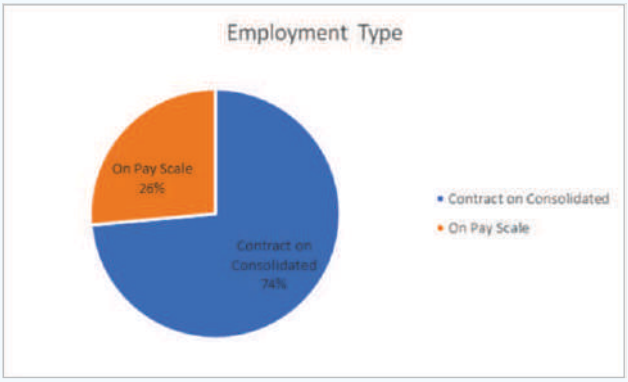
Functional Distribution

There has been a considerable increase in the manpower in C-DAC with around 4370 employees spread across 12 centres of C-DAC, with majority of them i.e. 91% being Scientific and Technical Manpower(S&T).



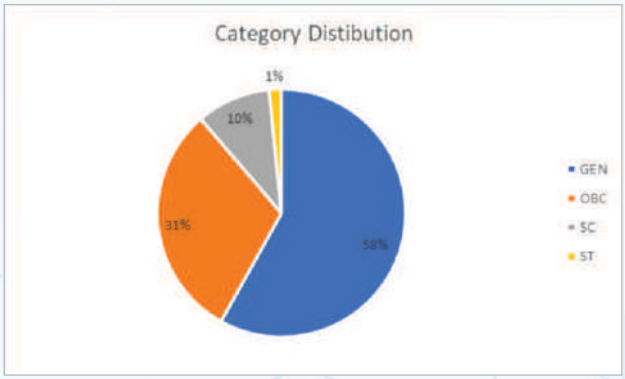
Type of Employment

C-DAC's employment model predominantly operates on a contractual basis, with most employees hired for specific projects or time-bound assignments. This approach allows for flexibility in workforce management, enabling the organization to quickly adapt to evolving technological needs and project demands while focusing on delivering high-quality research and development outcomes.



Caste Wise Distribution

C-DAC, as a premier R&D organization, operates with an exemption from reservation policies, but remains committed to inclusivity. The organization strives to engage and include employees from reserved categories as much as possible, reflecting its dedication to diversity and equitable opportunities within its workforce.



Conclusion

The HRD department at C-DAC remains committed to fostering a dynamic, inclusive, and innovative work environment. By focusing on talent development, employee engagement, and leadership growth, HRD ensures that C-DAC continues to lead in the field of advanced computing and IT. The initiatives undertaken over the past year reflect our commitment to excellence and our belief that a motivated and skilled workforce is the cornerstone of our success.

This write-up encapsulates the vital role HRD plays in C-DAC and highlights the significant initiatives taken to support the organization's strategic objectives.

Legal

Corporate Legal is effectively the single point of contact for all the legal issues of the 12 centres, most of whom does not have a legal officer at the centre and need support and guidance at regular intervals for all their legal issues.

Legal being critical with regard to impact, corporate legal has always striven hard to deliver effectively and efficiently in continuing to handle a multitude of activities with various stakeholders.

Some of the most important and critical assignments handled by Corporate legal has been vetting and re-vetting of the various MOUs and agreements being executed by C-DAC in pursuance of various projects whether sponsored/funded and/or business.

Apart from the above, legal has also been at the forefront in terms of providing legal opinion or resolving queries of the centres pertaining to various issues involving litigation, HR issues, as also in several Project execution matters

The Key Activities of the Corporate Legal are as follows:

- All centres of C-DAC and Corporate office has a Legal Department, which take up all the Legal issues relating to C-DAC.
- During the financial year (April 23- March 24) approx. 46 court cases were dealt at various CATs, High Courts, Tribunals, Courts and Arbitrators etc. These cases are mostly related to service matters of C-DAC centres.
- In addition to above, Legal department also drafted/vetted various MoUs/Agreements to be signed with various stake holders. During the period (April 2023- March 2024), approx. 532 MoUs /Agreements were vetted /drafted and re-vetted by the Corporate Legal Department. Apart from this, 96 legal opinions were given in various matters.
- Corporate Legal Department coordinates with MeitY ,the Advocates appearing on behalf of C-DAC and the various C-DAC Centres for the court cases and provides critical inputs supported by relevant judgements pronounced by various courts of India.
- In addition to this, Corporate Legal department conducted training / sessions on POSH and IPR for employees of C-DAC and ICC committee members.
- 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 2023, total 437 applications were received which were duly processed.

Vigilance Matters taken up during the year 2023-24

Total 05 complaints have been received in this year. 10 complaints were disposed off during the year.

Vigilance Operations and Functions:

As per the guidelines of the Central Vigilance Commission, Vigilance Awareness Week was observed in all C-DAC Centres during 30th October, 2023 to 05th November,2023. The observation of Vigilance Awareness Week commenced in all centres on 30th October 2023 with 899 employees, 133 customers and 204 citizens taking the integrity pledge with the theme of " "Say no to corruption; commit to the Nation". Moreover, students and families of staff joined in through online for taking pledge. All C-DAC Centres observed the Vigilance Week with overwhelming response by displaying Banners and posters related to vigilance awareness. Lecture sessions, essay writing competitions, quiz competitions, talks, panel discussions were also organized to create awareness.

In C-DAC Mohali, Expert Talk on Preventive Vigilance was delivered by Prof. (Dr.) Rattan Singh, Professor, University Institute of Legal Studies (UILS), Panjab University, Chandigarh on 30/10/2023, and a total 84 participants attended the session. Number of talks/seminars/public interactions/gram sabhas were conducted explaining the provisions of PIDPI resolution, the correct procedure of filing a PIDPI complaint and common pitfalls/mistakes made while filing PIDPI complaints. Group of 43 students from SLIET Longowal (Punjab) attended PIDPI awareness session during their visit to C-DAC Mohali on 11/10/2023. Essay writing competition and quiz competition and were also organized for the employees.

This year's theme was "Say no to corruption; commit to the Nation". A talk on the theme by Smt. Harshita Attaluri IPS, Inspector General of Police, Vigilance & Anti-Corruption Bureau, Govt. of Kerala was organised at main campus of C-DAC Thiruvananthapuram Centre on 31st October 2023.

C-DAC, Noida organized a Drawing Competition for all Employees & their family members to observe Vigilance Awareness Week from 30th Oct 2023 to 05th Nov 2023. Theme for Drawing Competition was "Say no to corruption; commit to the Nation. A one-hour session on "Preventive Vigilance Measures" was organized for the employees of CDAC Noida on 01st November 2023 by Sh. K.S Kumar. A session on "Public Interest Disclosure and Protection of Informers (PIDPI)" by Sh. Mukesh Chaturvedi, Director (Retd.), DoPT was also conducted.

C-DAC Hyderabad organized Quiz Competition, Poster making competition on vigilance awareness.

C-DAC Bangalore used Social Media to spread awareness about Vigilance Awareness Week 2023. Information about Vigilance Awareness Week was posted, along with relevant photos and videos, in Facebook, LinkedIn and Twitter handles of C-DAC Bangalore. Vigilance Awareness Week e-banner were also displayed at / near the receptions of both campuses of C-DAC Bangalore, in addition to PIDPI Banner / poster, videos and Jingles.

C-DAC Kolkata organized a special lecture session on 31.10.2023, on the topic "Promoting Good Governance-Positive Contribution of Vigilance", by Smt. Akanksha Bajpei, Scientist C, ERTL (E). AVO-C-DAC Kolkata also addressed all employees regarding the theme of VAW-2023 and basic objectives of Vigilance Awareness. Large number of employees attended the lecture session.

In Pune Centre a lecture was delivered on 1st November, 2023 by Shri Sunil Kumar Singh, Chief Vigilance Officer, Indian Post and Payment Bank, Department of Post, Govt. of India on the topic: “Vigilance Awareness”. 94 participants have attended this lecture.

C-DAC Mumbai organized sensitization sessions by various departments/sections for creating awareness amongst employees on organization's policies/procedures and preventive vigilance measures. Outreach activities to various vendors/suppliers of organization were also taken up by respective departments/sections for Integrity pledge.

Finance

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INDEPENDENT AUDITOR'S REPORT

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

Report on the Consolidated Financial Statements

Opinion

We have audited the accompanying Consolidated Financial Statements of **Centre For Development of Advance Computing, (C-DAC),** (Hereafter referred as "C-DAC ") which comprise the consolidated Balance sheet as at 31st March, 2024 and the consolidated Income and Expenditure Account and consolidated Receipts and Payments Accounts for the year then ended, and summary of significant accounting policies and other explanatory information (hereinafter referred to as "the consolidated financial statements") in which are incorporated the accounts for the year ended on that date audited by the Centre's auditors of the Centre's of the C-DAC located at (Bengaluru, Chennai, Corporate Office, Delhi, Hyderabad, Kolkata, Mohali, Mumbai, Noida, Patna, Pune, Silchar and Thiruvananthapuram).

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid consolidated financial statements give the information in the manner so required to the extent applicable and give true and fair view in conformity with the accounting principles generally accepted in India, of the state of affairs of the Centre as at 31st March, 2024, and its consolidated surplus and its consolidated receipts and payments for the year ended on that date.

Basis for Opinion

We conducted audit in accordance with standards on auditing issued by institute of Chartered Accountants of India. Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Consolidated Financial Statements section of our report. We are independent of the Centre in accordance with the Code of Ethics issued by the Institute of Chartered Accountants of India (ICAI) together with the independence requirements that are relevant to our audit of the consolidated financial statements under the provisions of the Act and the Rules made there under, and we have fulfilled our other ethical responsibilities in accordance with these requirements and the ICAI's Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion on the consolidated financial statements.

HO
Flat No 201, Third Floor,
Ideal Square, Nav Swarajya CHS,
CTS 786, Ideal Colony Lane 1,
Vasant Divekar Path, Off Paud Rd,
Kothrud, Pune 411038

GOGATE & COMPANY CHARTERED ACCOUNTANTS FRN NO. 124144W

T- 020- 6689 2143 I 70209 17128
E- gogateandco@gmail.com
Branches at- Mumbai I Sangli I Kolhapur

Management's Responsibility for the Financial Statements

The Centre's management is responsible for the preparation of these consolidated financial statements that give a true and fair view of the consolidated financial position, consolidated financial performance and consolidated receipts and payments of the C-DAC in accordance with the accounting principal generally accepted in India.

The management of the Centre's of C-DAC is responsible for the maintenance of adequate accounting records, safeguarding the assets of the Centre, for preventing and detecting frauds and other irregularities, selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the consolidated financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

In preparing the consolidated financial statements, the management of the Centre's of C-DAC is responsible for assessing the Centre 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 Centre's of C-DAC.

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

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

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

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

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

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

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

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

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

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

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

Report on Other Requirements

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

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

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

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

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

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

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

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

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

For M/s. Gogate & Co.(FRN: 124144W)
Chartered Accountants

CA Umesh Gogate
Partner (Membership No. 109574)
UDIN: 24109574BKFFKJ3117
Place: Pune
Date: 8th August, 2024.

CONSOLIDATED BALANCE SHEET AS AT 31st March 2024

Amount in ₹

Particulars	Schedule	2023-24	2022-23
CORPUS/CAPITAL FUND AND LIABILITIES			
Corpus/Capital Fund	1	10,56,90,23,268	8,00,33,37,367
Reserves and Surplus	2	3,89,54,17,213	4,02,56,23,568
Earmarked and Endowment Funds	3	1,52,90,34,907	2,22,87,74,662
Secured Loan from Bank		-	-
Current Liabilities and Provisions	4	7,70,14,11,468	6,43,78,03,780
Branch & Divisions		-	-
Total		**23,69,48,86,856**	**20,69,55,39,377**
ASSETS			
Fixed Assets			
Acquired out of Own Funds	5	60,69,46,076	48,41,38,879
Acquired out of Grant in Aid	6	1,78,87,47,210	1,84,68,94,807
Acquired out of Project Grants	7	2,10,66,70,004	2,17,87,28,762
Investments-Others		-	4,32,857
Current Assets, Loans & Advances	8	19,19,25,23,566	16,18,53,44,072
Miscellaneous Expenditure		-	-
Total		**23,69,48,86,856**	**20,69,55,39,377**
		-	-

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

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. Gogate & Co. (FRN: 124144W)
Chartered Accountants

CA Umesh Gogate
Partner (Membership No.109574)
UDIN: 24109574BKFFKJ3117
Place : Pune , Date : 8th August, 2024

CONSOLIDATED INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st March 2024

Amount in ₹

Particulars	Schedule	2023-24	2022-23
INCOME			
Income from Sales/Services	9	7,53,80,12,191	5,04,01,49,348
Grants/Subsidies	10	2,68,77,58,456	2,51,33,73,486
Fees/Subscription	11	90,58,90,372	1,11,36,92,219
Interest Earned	12	55,39,26,217	39,73,91,513
Other Income	13	8,75,92,935	6,51,98,140
Prior Period Income		(1,37,05,582)	1,54,60,780
Increase/(decrease) in stock of Finished Goods and Work-in-progress	14	19,55,63,915	51,86,29,328
TOTAL (A)		**11,95,50,38,504**	**9,66,38,94,814**
EXPENDITURE			
Establishment Expenses	15	4,53,74,13,693	4,23,99,45,736
Purchases	16	2,62,38,85,848	98,02,46,066
Direct Expenses	17	1,04,72,90,272	1,13,56,56,562
Expenses on Courses	18	38,84,48,736	44,56,35,939
Other Administrative Expenses	19	68,33,75,215	68,89,55,729
Prior Period Expenses		1,10,86,504	1,29,72,202
Depreciation (corresponding to Schedule 5)		13,92,47,469	8,89,71,063
TOTAL (B)		**9,43,07,47,737**	**7,59,23,83,297**
Transferred to / (from) Balance of Mission Grants		(13,94,769)	(3,55,74,009)
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CORPUS/CAPITAL FUND		**2,52,56,85,536**	**2,10,70,85,526**
SIGNIFICANT ACCOUNTING POLICIES	20		
NOTES TO ACCOUNTS	21		

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

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. Gogate & Co. (FRN: 124144W)
Chartered Accountants

CA Umesh Gogate
Partner (Membership No.109574)
UDIN: 24109574BKFFKJ3117
Place : Pune , Date : 8th August, 2024

Amount in ₹

Particulars	2023-24	2022-23
Schedule 1 - Corpus/Capital Fund		
Balance as at the beginning of the year	8,00,33,37,367	5,85,87,96,883
Add: Surplus as per Income & Expenditure Account	2,52,56,85,535	2,10,70,85,526
Less : Own contribution to Core / Projects and Other Adjustments / Transfers	(4,00,00,366)	(3,74,54,958)
Less : Corporate Office Contribution	-	-
Balance as at the year - end	**10,56,90,23,268**	**8,00,33,37,367**
Schedule 2 - Reserves and Surplus		
1. Capital Reserve :		
As per last Account	4,02,56,23,568	3,80,01,86,315
Addition during the year	1,00,43,69,552	1,51,35,80,468
Less : Deductions during the year	1,13,45,75,907	1,28,81,43,215
Total	**3,89,54,17,213**	**4,02,56,23,568**
Schedule 3 - Earmarked/Endowment Funds		
1. Balance of Core Grants		
a) Opening balance of the funds	3,00,23,680	6,50,10,804
b) Additions to the Funds		
I) Donations/Grants	2,70,00,00,000	2,50,00,00,000
II) Income from Investments made on account of funds	-	-
III) Other additions (C-DAC Contribution and Other Income)	3,88,67,235	3,23,91,137
Total (b)	2,73,88,67,235	2,53,23,91,137
Total (a)+(b)	2,76,88,90,915	2,59,74,01,941
c) Utilization/Expenditure towards objectives of funds		
I) Capital Expenditure		
Fixed Assets	5,09,37,925	1,84,32,737
Others	-	-
Total I	5,09,37,925	1,84,32,737
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	2,42,52,37,852	2,29,76,69,330
Componants, Consumables and Other Direct Expenses	30,52,805	1,06,81,875
Travel	2,38,39,826	1,73,99,677
Contingencies, Overheads and Other Administrative Expenditure	23,71,89,976	22,31,94,642
Total II	2,68,93,20,459	2,54,89,45,524
Total (c)	2,74,02,58,384	2,56,73,78,261
Net Balance as at Year - End (a+b-c) Total 1	2,86,32,531	3,00,23,680
Projects wise Allocated Core Grant Projects (Details as per Annexure 1)		
d) Opening balance	(11,24,75,293)	(14,42,65,033)
e) Additions to the Funds		
I) Donations/Grants	-	-
II) Income from Investments made on account of	-	-
III) Other additions (C-DAC Contribution and Other	78,18,167	4,09,91,206
Total (e)	78,18,167	4,09,91,206
Total (d)+(e)	(10,46,57,126)	(10,32,73,827)

Amount in ₹

Particulars	2023-24	2022-23
f) Utilization/Expenditure towards objectives of		
I) Capital Expenditure		
Fixed Assets	63,37,763	92,01,466
Others	-	-
Total I	63,37,763	92,01,466
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)	63,37,763	92,01,466
g) Refund / Transfer and Other Adjustments	-	-
Net Balance as at Year - End (d+e-f-g) Total 2	(11,09,94,889)	(11,24,75,293)
Core Grant Balance as at Year - End (Total 1 + Total 2) Total 3	(8,23,62,358)	(8,24,51,613)
2. Grants for Funded Projects (Details as per Annexure 2)		
a) Opening balance of the funds	2,30,40,75,318	10,94,87,14,692
b) Additions to the Funds		
I) Donations/Grants	9,28,73,40,445	6,15,13,00,102
II) Income from Investments made on account of funds	5,20,66,165	26,34,70,886
III) Other additions (C-DAC Contribution and Other Income)	21,14,773	4,91,68,530
Total (b)	9,34,15,21,383	6,46,39,39,518
Total (a)+(b)	11,64,55,96,701	17,41,26,54,210
c) Utilization/Expenditure towards objectives of funds		
I) Capital Expenditure		
Fixed Assets	94,45,87,164	1,48,60,82,832
Others	-	-
Total I	94,45,87,164	1,48,60,82,832
II) Revenue Expenditure		
Salaries, Wages and Allowances etc.	1,68,64,13,084	1,48,71,27,552
Componants, Consumables and Other Direct Expenses	3,74,27,73,404	1,78,19,36,766
Travel	14,27,10,529	26,75,19,716
Contingencies, Overheads and Other Administrative Expenditure	1,02,17,61,328	1,03,53,29,205
Total II	6,59,36,58,345	4,57,19,13,239
Total (c)	7,53,82,45,509	6,05,79,96,071
d) Refund / Transfer and Other Adjustments	2,50,33,18,340	9,05,05,82,821
Net Balance as at Year - End (a+b-c-d) Total 4	1,60,40,32,852	2,30,40,75,318
3. Employee and Other Funds:		
As per last Account	71,50,957	69,65,417
Addition during the year	2,13,455	1,85,540
Less : Deductions during the year	-	-
Total 5	73,64,412	71,50,957
Grand Total (Total 3+ Total 4+Total 5)	**1,52,90,34,907**	**2,22,87,74,662**

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	(11,24,75,293)	-	-	78,18,167	63,37,763	-	-	-	-	63,37,763	-	(11,09,94,889)
2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**(11,24,75,293)**	**-**	**-**	**78,18,167**	**63,37,763**	**-**	**-**	**-**	**-**	**63,37,763**	**-**	**(11,09,94,889)**

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CDAC

Centre for Development of Advanced Computing, Pune
CONSOLIDATED ANNUAL ACCOUNTS 2023-24

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.	Components, Consumables and Other Direct Expenses	Travel	Contingencies, Overheads and Other Administrative Expenditure	Total Expenses	Refund / Transfer & Other Adjustments	Closing Balance
1	**Bangalore Centre**												
	MeitY Projects	(3,22,46,816)	36,14,73,771	-	-	5,51,40,908	8,78,80,608	16,44,92,235	90,32,671	3,70,70,796	35,36,17,218	1,56,11,269	(4,00,01,532)
	Other Agency Projects	18,15,927	49,14,654	-	-	-	29,68,235	11,36,666	5,02,969	3,23,292	49,31,162	4,54,505	13,44,914
	Total Bangalore Centre	(3,04,30,889)	36,63,88,425	-	-	5,51,40,908	9,08,48,843	16,56,28,901	95,35,640	3,73,94,088	35,85,48,380	1,60,65,774	(3,86,56,618)
2	**Chennai Centre**												
	MeitY Projects	(92,99,408)	1,32,46,000	-	-	-	9,37,000	29,90,010	-	19,582	39,46,592	-	-
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Chennai Centre	(92,99,408)	1,32,46,000	-	-	-	9,37,000	29,90,010	-	19,582	39,46,592	-	-
3	**Corporate Office**												
	MeitY Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Corporate Office	-	-	-	-	-	-	-	-	-	-	-	-
4	**Delhi Centre**												
	MeitY Projects	(40,67,773)	3,02,41,580	-	-	-	2,18,39,860	27,50,230	2,98,480	25,46,742	2,74,35,312	2,885	(12,64,390)
	Other Agency Projects	11,14,49,379	2,41,50,033	-	-	-	1,13,27,202	2,58,56,612	24,78,712	9,25,361	4,05,87,887	4,93,44,460	4,56,67,065
	Total Delhi Centre	10,73,81,606	5,43,91,613	-	-	-	3,31,67,062	2,86,06,842	27,77,192	34,72,103	6,80,23,199	4,93,47,345	4,44,02,675
5	**Hyderabad Centre**												
	MeitY Projects	6,01,40,313	28,50,58,208	1,02,35,287	-	6,82,71,303	8,83,50,284	94,73,887	76,78,424	2,41,37,708	19,79,11,606	11,25,46,453	4,49,75,749
	Other Agency Projects	87,42,315	4,39,36,087	9,43,453	-	1,90,79,280	5,67,77,257	23,00,509	46,28,722	1,02,87,351	9,30,73,119	65,27,571	(4,59,78,835)
	Total Hyderabad Centre	6,88,82,628	32,89,94,295	1,11,78,740	-	8,73,50,583	14,51,27,541	1,17,74,396	1,23,07,146	3,44,25,059	29,09,84,725	11,90,74,024	(10,03,086)
6	**Kolkata Centre**												
	MeitY Projects	-	8,86,44,361	-	-	25,43,191	5,24,71,879	1,16,87,205	58,22,129	1,51,16,413	8,86,40,817	3,544	-
	Other Agency Projects	1,49,93,335	93,96,809	6,640	-	1,49,978	1,39,57,427	12,77,019	8,40,354	6,91,792	1,69,16,570	-	74,80,214
	Total Kolkata Centre	1,49,93,335	9,80,41,170	6,640	-	26,93,169	6,64,29,306	1,29,64,224	66,62,483	1,68,08,205	10,55,57,387	3,544	74,80,214
7	**Mohali Centre**												
	MeitY Projects	(61,71,310)	13,67,48,270	-	-	38,89,862	2,83,67,181	3,54,85,537	30,43,141	2,80,11,798	9,87,97,519	3,23,00,419	(5,20,978)
	Other Agency Projects	29,34,65,760	11,70,48,812	68,19,715	-	58,20,946	13,04,94,393	36,68,088	53,08,535	19,89,28,414	34,42,20,376	7,32,21,602	(1,07,691)
	Total Mohali Centre	28,72,94,450	25,37,97,082	68,19,715	-	97,10,808	15,88,61,574	3,91,53,625	83,51,676	22,69,40,212	44,30,17,895	10,55,22,021	(6,28,669)
8	**Mumbai Centre**												
	MeitY Projects	(1,67,01,252)	19,93,44,000	-	-	2,32,50,512	11,42,03,618	9,11,676	48,40,045	4,38,72,523	18,70,78,374	-	(44,35,626)
	Other Agency Projects	1,12,76,984	23,61,737	2,63,829	-	1,32,926	1,07,78,032	2,15,382	2,13,922	19,29,599	1,32,69,861	3,03,222	3,29,467
	Total Mumbai Centre	(54,24,268)	20,17,05,737	2,63,829	-	2,33,83,438	12,49,81,650	11,27,058	50,53,967	4,58,02,122	20,03,48,235	3,03,222	(41,06,159)
9	**Noida Centre**												
	MeitY Projects	1,54,65,765	49,30,12,464	-	-	2,90,73,435	17,10,35,820	88,98,465	64,62,209	21,95,79,704	43,50,49,633	7,18,87,597	15,40,999
	Other Agency Projects	2,89,11,203	3,70,67,500	8,437	-	8,35,440	4,46,88,999	10,99,084	31,819	61,77,590	5,28,32,932	17,17,208	1,14,37,000
	Total Noida Centre	4,43,76,968	53,00,79,964	8,437	-	2,99,08,875	21,57,24,819	99,97,549	64,94,028	22,57,57,294	48,78,82,565	7,36,04,805	1,29,77,999
10	**Patna Centre**												
	MeitY Projects	-	4,60,98,253	-	-	1,91,26,153	1,73,30,000	29,13,370	25,42,000	34,54,000	4,53,65,523	7,32,730	-
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Patna Centre	-	4,60,98,253	-	-	1,91,26,153	1,73,30,000	29,13,370	25,42,000	34,54,000	4,53,65,523	7,32,730	-
11	**Pune Centre**												
	MeitY Projects	(40,27,48,854)	3,51,70,78,004	-	-	26,24,13,214	43,01,20,892	1,74,86,07,205	4,25,38,503	22,47,27,458	2,70,84,07,272	19,57,32,647	21,01,89,232
	Other Agency Projects	2,07,80,77,050	2,97,82,84,599	3,32,70,537	-	5,64,19,785	7,04,78,515	1,68,88,78,311	1,58,77,484	13,17,94,639	1,96,34,48,734	1,90,88,19,097	1,21,73,64,355
	Total Pune Centre	1,67,53,28,196	6,49,53,62,603	3,32,70,537	-	31,88,32,999	50,05,99,407	3,43,74,85,516	5,84,15,987	35,65,22,097	4,67,18,56,006	2,10,45,51,744	1,42,75,53,587
12	**Silchar Centre**												
	MeitY Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Other Agency Projects	-	-	-	-	-	-	-	-	-	-	-	-
	Total Silchar Centre	-	-	-	-	-	-	-	-	-	-	-	-
13	**Thiruvananthapuram Centre**												
	MeitY Projects	9,88,21,093	86,66,07,864	4,31,479	21,14,773	39,61,37,265	31,22,79,610	2,46,12,806	2,62,84,512	6,81,87,747	82,75,01,940	3,36,50,714	10,68,22,554
	Other Agency Projects	5,21,51,607	3,26,27,439	86,788	-	23,02,966	2,01,26,272	55,19,107	42,85,898	29,78,819	3,52,13,062	4,62,417	4,91,90,355
	Total Thiruvananthapuram Centre	15,09,72,700	89,92,35,303	5,18,267	21,14,773	39,84,40,231	33,24,05,882	3,01,31,913	3,05,70,410	7,11,66,566	86,27,15,002	3,41,13,131	15,60,12,909
	Total MeitY Projects	**(29,68,08,242)**	**6,03,75,52,775**	**1,06,66,766**	**21,14,773**	**85,98,45,843**	**1,32,48,16,752**	**2,01,28,22,626**	**10,85,42,114**	**66,77,24,471**	**4,97,37,51,806**	**46,24,68,258**	**31,73,06,008**
	Total Other Agency Projects	**2,60,08,83,560**	**3,24,97,87,670**	**4,13,99,399**	**-**	**8,47,41,321**	**36,15,96,332**	**1,72,99,50,778**	**3,41,68,415**	**35,40,36,857**	**2,56,44,93,703**	**2,04,08,50,882**	**1,28,67,26,844**
	Grand Total	**2,30,40,75,318**	**9,28,73,40,445**	**5,20,66,165**	**21,14,773**	**94,45,87,164**	**1,68,64,13,084**	**3,74,27,73,404**	**14,27,10,529**	**1,02,17,61,328**	**7,53,82,45,509**	**2,50,33,18,340**	**1,60,40,32,852**

Amount in ₹

Particulars	2023-24	2022-23
Schedule 4 - Current Liabilities and Provisions		
A. Current Liabilities		
1. Trade Payables (For Goods and Others)	1,89,08,17,387	1,50,43,30,354
2. Advances Received		
a) Advances Received from Parties	3,93,68,43,524	2,64,07,61,667
b) Fees Received in Advance	-	36,299
c) AMC Charges Received in Advance	-	-
d) Other Income Received in Advance	30,84,55,782	29,21,57,742
3. Statutory Liabilities		
a) Members CPF Recovery Payable	2,01,26,089	1,64,22,711
b) Members VPF Payable	15,11,565	11,89,641
c) Members CPF Loan Recovery Payable	-	-
d) Members Benevolent Fund Payable	4,72,767	6,45,497
e) Members CGEIS/Group Insurance Payable	59,517	65,118
f) Members Other Recoveries Payable	11,37,648	45,56,923
g) C-DAC's Contribution to CPF Payable	2,54,86,284	3,99,52,685
h) Gratuity Payable	8,90,60,390	8,07,14,419
i) Leave Salary and Pension Contribution Payable	50,89,44,495	43,91,84,331
j) Members Income Tax Payable	3,74,68,002	3,15,68,353
k) Tax Deducted at Source Payable	9,53,40,357	8,48,75,822
l) Profession Tax Payable	2,90,495	2,11,104
m) Service Tax Payable	-	-
n) CGST Payable	1,17,66,217	2,20,06,908
o) SGST Payable	83,59,952	1,80,10,836
p) IGST Payable	14,76,18,696	20,21,26,691
q) UTGST Payable	-	-
r) Reverse charge GST Payable	7,23,581	85,48,436
4. Other Current Liabilities		
a) Unpaid Salaries	1,04,91,401	2,35,83,393
b) Library Deposits Payable	83,500	82,700
c) Other Security Deposits Payable	5,88,86,854	5,40,47,686
d) Earnest Money Deposit Contractors Payable	2,97,55,275	1,20,76,244
e) Retention Deposit Contractors	88,34,394	68,01,229
f) Refund of Course Fees Due	23,85,131	20,15,681
g) ATC's & Others Share in Fees Payable	410	87,934
h) Other Current Liabilities	12,63,02,995	44,88,39,523
Total (A)	7,32,12,22,708	5,93,48,99,927
B. Provisions		
1. Others (Specify)		
a) Provisions / Accrued Liabilities for Expenses	38,01,88,760	50,29,03,853
Total (B)	38,01,88,760	50,29,03,853
Total (A)+(B)	**7,70,14,11,468**	**6,43,78,03,780**

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

Amount in ₹

Sr. No.	Particulars	Gross Block						Depreciation					Net Block	
		Cost/Valuation as on beginning of the year	Additions During the Year			Deletion/Adjustments During the Year	Cost/Valuation as on end of the year	Depreciation as at beginning of the year	Depreciation Written Back	Depreciation Rate	Depreciation for Current Year	Total Depreciation up to the year end	WDV (Closing)	WDV (Opening)
			On or Before 30th September	After 30th September	Total Additions during the year									
A	B		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	-	2	2	-	17,21,96,625	2,30,11,967	-	0%	6,97,292	2,37,09,259	14,84,87,366	14,91,84,656
2	Building													
	a) On Freehold Land	91,18,277	-	-	-	-	91,18,277	66,70,474	-	10%	2,44,780	69,15,254	22,03,023	24,47,803
	b) On Leasehold Land	10,89,53,874	2,62,388	15,02,759	17,65,147	-	11,07,19,021	9,37,22,249	-	10%	16,99,677	9,54,21,926	1,52,97,095	1,52,31,625
	c) Ownership Flats/Premises	3,97,26,295	-	-	-	-	3,97,26,295	3,49,80,761	-	10%	4,74,553	3,54,55,314	42,70,981	47,45,534
	d) Superstructures on Land not belonging to the entity	1,34,26,841	-	-	-	-	1,34,26,841	1,25,81,828	-	10%	84,502	1,26,66,330	7,60,511	8,45,013
3	Plant, Machinery and Equipments	9,32,27,446	87,68,000	6,91,743	94,59,743	1,15,440	10,25,71,749	5,74,61,833	1,14,614	15%	67,83,679	6,41,30,898	3,84,40,851	3,57,65,613
4	Vehicles	2,40,90,614	20,71,899	56,21,222	76,93,121	18,52,262	2,99,31,473	1,45,38,853	17,55,238	15%	25,72,179	1,53,55,794	1,45,75,679	95,51,761
5	Furniture & Fixtures	12,12,31,690	29,45,558	62,92,815	92,38,373	3,68,004	13,01,02,059	7,99,95,686	3,30,943	10%	50,43,733	8,47,08,476	4,53,93,582	4,12,36,003
6	Office Equipments	5,49,83,481	22,30,406	64,14,179	86,44,585	7,15,897	6,29,12,169	3,80,59,344	7,04,646	15%	38,33,621	4,11,88,319	2,17,23,850	1,69,24,137
7	Air Conditioning Equipments	4,03,14,059	6,73,189	10,60,396	17,33,585	9,52,650	4,10,94,994	3,00,10,076	7,89,598	15%	17,81,177	3,10,01,655	1,00,93,338	1,03,03,982
8	Computer Peripherals	57,97,58,809	7,04,21,204	10,90,88,341	17,95,09,545	-	75,92,68,354	48,49,63,033	-	40%	10,97,22,126	59,46,85,159	16,45,83,195	9,47,95,776
9	Electrical Installations	7,79,66,511	81,43,120	5,82,815	87,25,935	7,11,875	8,59,80,571	5,49,15,031	6,04,811	10%	31,67,037	5,74,77,257	2,85,03,313	2,30,51,478
10	Electronic Tools & Lab Equipments	1,75,11,847	1,15,404	42,48,996	43,64,400	-	2,18,76,247	1,05,36,499	-	15%	17,00,962	1,22,37,461	96,38,786	69,75,348
11	Library Books	1,63,10,189	96,138	1,45,486	2,41,624	10,65,883	1,54,85,930	1,58,36,106	10,58,116	40%	2,83,175	1,50,61,165	4,24,765	4,74,083
12	Copyright Know-how	66,950	-	-	-	-	66,950	66,452	-	25%	125	- 66,577	373	498
13	Other Fixed Assets	1,20,27,714	16,36,034	4,31,601	20,67,635	18,950	1,40,76,399	63,68,565	17,841	15%	11,58,851	75,09,575	65,66,824	56,59,149
	Total	**1,41,30,78,695**	**9,73,63,340**	**13,60,80,355**	**23,34,43,695**	**58,00,961**	**1,64,07,21,429**	**96,37,18,759**	**53,75,807**		**13,92,47,469**	**1,09,75,90,419**	**54,31,31,007**	**44,93,59,934**
	Capital Work-in-progress	**3,47,78,949**	**96,27,049**	**1,94,09,078**	**2,90,36,127**	**-**	**6,38,15,076**	**-**	**-**		**-**	**-**	**6,38,15,076**	**3,47,78,949**
	Grand Total	**1,44,78,57,644**	**10,69,90,389**	**15,54,89,433**	**26,24,79,822**	**58,00,961**	**1,70,45,36,505**	**96,37,18,759**	**53,75,807**		**13,92,47,469**	**1,09,75,90,419**	**60,69,46,076**	**48,41,38,879**
	Previous Year	**1,24,72,38,703**	**3,21,37,644**	**14,75,15,673**	**17,96,53,317**	**(2,09,65,624)**	**1,44,78,57,644**	**85,23,02,374**	**(2,24,45,322)**		**8,89,71,064**	**96,37,18,759**	**48,41,38,879**	**39,49,36,323**

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

Amount in ₹

Sr. No.	Particulars	Gross Block						Depreciation					Net Block	
		Cost/Valuation as on beginning of the year	Additions During the Year			Deletion/Adjustments During the Year	Cost/Valuation as on end of the year	Depreciation as at beginning of the year	Depreciation Written Back	Depreciation Rate	Depreciation for Current Year	Total Depreciation up to the year end	WDV (Closing)	WDV (Opening)
			On or Before 30th September	After 30th September	Total Additions during the year									
A	B		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	33,81,812	-	0%	1,71,770	35,53,582	1,31,92,129	1,33,63,899
2	Building													
	a) On Freehold Land	21,87,89,031	5,54,560	59,51,771	65,06,331	-	22,52,95,362	14,78,81,761	-	10%	77,41,360	15,56,23,121	6,96,72,241	7,09,07,270
	b) On Leasehold Land	67,39,51,747	31,25,68,297	16,72,220	31,42,40,517	-	98,81,92,264	21,67,10,296	-	10%	7,71,48,198	29,38,58,494	69,43,33,770	45,72,41,451
	c) Ownership Flats/Premises	10,50,015	-	-	-	-	10,50,015	9,28,066	-	10%	12,195	9,40,261	1,09,754	1,21,949
	d) Superstructures on Land not belonging to the entity	53,89,260	-	-	-	-	53,89,260	14,60,489	-	10%	3,92,877	18,53,366	35,35,894	39,28,771
3	Plant, Machinery and Equipments	8,89,90,819	-	-	-	-	8,89,90,819	8,19,59,852	-	15%	10,54,644	8,30,14,496	59,76,323	70,30,967
4	Vehicles	65,05,279	-	-	-	16,02,171	49,03,108	61,90,152	14,98,146	15%	31,665	47,23,671	1,79,437	3,15,127
5	Furniture & Fixtures	15,14,86,677	3,67,473	22,82,706	26,50,179	41,035	15,40,95,821	10,75,40,288	37,628	10%	46,59,318	11,21,61,978	4,19,33,843	4,39,46,389
6	Office Equipments	5,60,73,244	2,55,447	13,89,840	16,45,287	16,640	5,77,01,891	4,84,85,271	16,428	15%	13,84,957	4,98,53,800	78,48,091	75,87,973
7	Air Conditioning Equipments	5,09,79,192	-	-	-	-	5,09,79,192	4,17,69,517	-	15%	13,81,453	4,31,50,970	78,28,222	92,09,675
8	Computer Peripherals	1,18,35,03,214	54,50,384	71,56,298	1,26,06,682	-	1,19,61,09,896	1,14,53,16,148	-	40%	2,03,17,498	1,16,56,33,646	3,04,76,250	3,81,87,066
9	Electrical Installations	7,82,90,941	-	30,00,000	30,00,000	-	8,12,90,941	5,71,70,351	-	10%	24,12,059	5,95,82,410	2,17,08,531	2,11,20,590
10	Electronic Tools & Lab Equipments	10,16,70,235	13,87,390	4,79,479	18,66,869	-	10,35,37,104	9,38,66,747	-	15%	14,50,553	9,53,17,300	82,19,804	78,03,488
11	Library Books	3,99,87,932	1,47,640	-	1,47,640	19,20,783	3,82,14,789	3,99,63,233	19,20,018	40%	68,630	3,81,11,845	1,02,944	24,699
12	Copyright Know-how	4,40,660	-	-	-	-	4,40,660	4,40,655	-	25%	1	4,40,656	4	5
13	Other Fixed Assets	73,49,653	-	-	-	-	73,49,653	66,93,570	-	15%	98,413	67,91,983	5,57,670	6,56,083
	Total	**2,68,61,08,460**	**32,07,31,191**	**2,19,32,314**	**34,26,63,505**	**35,80,629**	**3,02,51,91,336**	**1,99,97,58,208**	**34,72,220**		**11,83,25,591**	**2,11,46,11,579**	**91,05,79,757**	**68,63,50,252**
	Capital Work-in-progress	1,16,05,44,555	63,49,123	1,75,04,309	2,38,53,432	30,62,30,534	**87,81,67,453**	-	-		-	-	87,81,67,453	1,16,05,44,555
	Grand Total	**3,84,66,53,015**	**32,70,80,314**	**3,94,36,623**	**36,65,16,937**	**30,98,11,163**	**3,90,33,58,789**	**1,99,97,58,208**	**34,72,220**		**11,83,25,591**	**2,11,46,11,579**	**1,78,87,47,210**	**1,84,68,94,807**
	Previous Year	3,83,19,73,838	76,37,654	2,78,70,004	3,55,07,658	2,08,28,481	3,84,66,53,015	1,91,48,14,077	1,28,18,618		9,77,62,749	1,99,97,58,208	1,84,68,94,807	1,91,71,59,761

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

Amount in ₹

Sr. No.	Particulars	Gross Block						Depreciation					Net Block	
		Cost/Valuation as on beginning of the year	Additions During the Year			Deletion/Adjustments During the Year	Cost/Valuation as on end of the year	Depreciation as at beginning of the year	Depreciation Written Back	Depreciation Rate	Depreciation for Current Year	Total Depreciation up to the year end	WDV (Closing)	WDV (Opening)
			On or Before 30th September	After 30th September	Total Additions during the year									
A	B		D	E	F	G	H	I	J	K	L	M	N	O
1	Bangalore Centre Project Assets	38,24,04,799	1,34,57,238	4,16,83,670	5,51,40,908	-	43,75,45,707	35,51,33,505	-		2,95,49,821	38,46,83,326	5,28,62,382	2,72,71,295
2	Chennai Centre Project Assets	9,85,57,018	-	-	-	-	9,85,57,018	9,21,76,550	-		13,49,641	9,35,26,191	50,30,827	63,80,468
3	Corporate Project Assets	-	-	-	-	-	-	-	-		-	-	-	-
4	Delhi Centre Project Assets	15,72,623	-	-	-	-	15,72,623	15,69,114	-		539	15,69,653	2,970	3,509
5	Hyderabad Centre Project Assets	46,83,54,771	4,07,37,479	4,66,13,104	8,73,50,583	-	55,57,05,354	39,01,41,331	-		6,75,85,038	45,77,26,369	9,79,78,986	7,82,13,440
6	Kolkata Centre Project Assets	6,34,39,046	18,83,472	8,09,697	26,93,169	-	6,61,32,215	4,50,13,386	-		84,47,530	5,34,60,916	1,26,71,299	1,84,25,660
7	Mohali Centre Project Assets	18,13,49,570	9,23,201	87,87,607	97,10,808	-	19,10,60,378	13,78,98,114	-		1,81,41,911	15,60,40,025	3,50,20,353	4,34,51,456
8	Mumbai Centre Project Assets	37,90,38,769	76,35,724	1,57,47,714	2,33,83,438	12,52,621	40,11,69,586	34,22,19,046	12,22,715		2,13,17,713	36,23,14,044	3,88,55,542	3,68,19,723
9	Noida Centre Project Assets	21,80,89,552	47,74,138	2,51,34,737	2,99,08,875	-	24,79,98,427	13,01,54,718	-		2,59,65,406	15,61,20,124	9,18,78,303	8,79,34,833
10	Patna Centre Project Assets	-	-	1,91,26,153	1,91,26,153	-	1,91,26,153	-	-		76,50,461	76,50,461	1,14,75,692	-
11	Pune Centre Project Assets	3,82,92,27,528	1,52,99,360	30,35,33,639	31,88,32,999	-	4,14,80,60,527	2,54,32,94,839	-		64,18,49,161	3,18,51,44,000	96,29,16,527	1,28,59,32,690
12	Silchar Centre Project Assets	-	-	-	-	-	-	-	-		-	-	-	-
13	Thiruvananthapuram Centre Project Assets	1,51,32,21,113	6,18,00,585	33,66,39,646	39,84,40,231	4,60,000	1,91,12,01,344	91,89,25,425	94,300		19,43,93,096	1,11,32,24,221	79,79,77,123	59,42,95,688
	Total	**7,13,52,54,789**	**14,65,11,197**	**79,80,75,967**	**94,45,87,164**	**17,12,621**	**8,07,81,29,332**	**4,95,65,26,028**	**13,17,015**		**1,01,62,50,317**	**5,97,14,59,330**	**2,10,66,70,004**	**2,17,87,28,762**
	Capital Work-in-progress	-	-	-	-	-	-	-	-		-	-	-	-
	Grand Total	**7,13,52,54,789**	**14,65,11,197**	**79,80,75,967**	**94,45,87,164**	**17,12,621**	**8,07,81,29,332**	**4,95,65,26,028**	**13,17,015**		**1,01,62,50,317**	**5,97,14,59,330**	**2,10,66,70,004**	**2,17,87,28,762**
	Previous Year	**5,64,91,72,400**	**28,89,68,133**	**1,19,71,14,701**	**1,48,60,82,834**	**443**	**7,13,52,54,789**	**3,76,61,45,846**	**283**		**1,19,03,80,467**	**4,95,65,26,028**	**2,17,87,28,762**	**1,88,30,26,554**

Amount in ₹

Particulars	2023-24	2022-23

Schedule 8 - Current Assets, Loans and Advances

A. Current Assets		
1. Inventories :		
a) Stock in trade		
Finished Goods	75,61,551	94,42,011
Work-in-progress	86,47,78,000	66,75,39,000
Raw Material	16,29,517	17,21,324
b) Stock of Course Material	27,40,320	24,43,138
2. Sundry Debtors		
Trade Receivables	2,44,21,14,965	1,79,28,41,841
Less: Provision for Bad and Doubtful Debts	34,43,38,688	33,86,94,529
	2,09,77,76,277	1,45,41,47,312
3. Cash balances in hand (including cheques/drafts and imprest)	259	222
4. Bank Balances		
a) With Scheduled Banks		
On Deposit Accounts (Includes margin money)	9,36,39,61,412	7,20,24,64,233
On Savings/Current Account	3,95,90,99,556	4,78,20,97,587
b) Funds/Goods in Transit	4,15,20,331	2,78,48,950
5. Post Office-Savings Accounts	7,228	5,828
Total (A)	16,33,90,74,451	14,14,77,09,605
B. Loans, Advances and Other Assets		
1. Loans		
a) Staff	47,46,531	51,62,000
b) Other (Specify)	15,70,678	9,40,004
2. Advances and other amounts recoverable in cash or in kind or for value to be received		
a) On Capital Account	-	50,89,256
b) Prepayments (Advances to Suppliers)	1,27,87,36,247	1,14,24,21,755
c) To Employees	63,80,214	1,03,76,176
d) To Others	76,88,793	3,20,64,936
3. Income Accrued		
a) On Investments from Earmarked/Endowment Funds	-	-
b) On Bank Deposits	33,99,51,008	19,91,18,399
c) Others		
I) Course Fee Receivable	33,09,170	27,44,840
ii) Receivable from Guest House Receipts	-	-
iii) Other Grants Receivables	-	-
4. Claims Receivable		
a) Insurance Claims Lodged but not received	-	-
b) Claims due but not received	-	-
c) Income Tax Deducted at Source	38,94,60,849	26,63,16,694
d) Sales Tax / VAT Refund Due	-	-
e) CGST Receivable	73,23,296	80,91,681
f) SGST Receivable	73,23,296	80,91,681
g) IGST Receivable	5,25,99,681	6,71,56,949
h) UTGST Receivable	-	-
i) Reverse Charge GST Receivable	-	-
j) Input Tax Credit GST Receivable	2,93,03,310	1,84,58,546
k) GST Paid on Advance Receipt	32,87,20,713	7,30,66,233
l) Receivable from PF Trust	8,328	-
m) Other Receivables	15,77,92,437	19,61,808
5. Prepaid Expenses		
a) Insurance	20,44,787	12,25,235
b) Other Expenses	6,71,04,255	3,05,50,813
6. Deposits (Assets)		
a) Telephone Deposit	12,45,715	12,65,715
b) Lease Rent Deposit	43,61,112	4,01,40,217
c) Other Deposits	6,82,67,017	6,94,76,423
d) Security Deposit	1,58,43,161	1,14,67,581
e) EMD / Tender Deposit	3,71,05,254	4,24,47,525
7. Deferred Expenses		
a) Unutilised Modvat / Cenvat	-	-
b) Deferred Expenses on Projects	4,25,63,263	-
Total (B)	2,85,34,49,115	2,03,76,34,467
Total (A+B)	**19,19,25,23,566**	**16,18,53,44,072**

Amount in ₹

Particulars	2023-24	2022-23
Schedule 9 - Income from Sales/Services		
1. Income from Sales		
a) Sale of Finished Goods	2,35,90,93,521	37,40,98,611
b) Sale of Raw Material	-	-
c) Sale of Scraps	8,89,730	24,28,805
2. Income from Services		
a) Software Development Charges	1,19,94,33,682	98,98,45,348
b) Others (Specify)	-	-
AMC Charges Received	16,54,10,927	8,64,01,467
Consultancy Charges / Service Charges	3,53,86,14,680	3,34,79,84,196
TOT Fees Received	74,96,610	87,02,372
Royalty Received	1,00,27,370	1,35,55,382
Data Charges	25,70,45,671	21,66,58,167
3. Inter Unit / Inter Branch Sales / (Purchases)	-	4,75,000
Total	**7,53,80,12,191**	**5,04,01,49,348**
Schedule 10 - Grants/Subsdies		
1. Central Government	2,70,00,00,000	2,50,00,00,000
2. Others (Specify)		
a) C-DAC's own Contribution and Other Adjustments	3,87,00,000	3,23,93,108
3. Less : Amount utilised for Capital Expenditure in the current year transferred to Capital Reserve	5,09,41,544	1,90,19,622
Total	**2,68,77,58,456**	**2,51,33,73,486**
Schedule 11 - Fees/Subscriptions		
1. Entrance Fees	-	-
2. Course Fees	80,22,51,170	1,04,39,13,235
3. Corporate Training Fees	4,47,60,901	88,17,735
4. Annual Fees/Subscriptions	75,75,350	60,19,155
5. Authorization Fees	12,32,252	12,00,537
6. Others (Specify)	-	-
a) Virtual Centre Processing Fees	-	-
b) Admission Cancellation Fees	38,03,525	27,73,641
c) Examination Fees	3,40,98,068	3,70,67,666
d) Late Fee	24,711	14,250
e) Registration Fees / Project Fee	6,68,093	1,06,000
f) Students Hostel Fees	1,14,76,302	1,37,80,000
TOTAL	**90,58,90,372**	**1,11,36,92,219**
Schedule 12 - Interest Received		
1. On Term Deposits		
a) With Scheduled Banks	49,69,59,838	33,78,15,588
2. On Savings Accounts		
a) With Scheduled Banks	5,52,93,964	5,88,64,903
3. On Loans		
a) Employees/Staff	16,72,415	7,11,022
Total	**55,39,26,217**	**39,73,91,513**
Schedule 13 - Other Income		
1. Profit on Sale/Disposal of Assets		
a) Owned Assets	3,14,232	(3,95,107)
b) Assets acquired out of grants, or received free of cost	1,67,235	(1,48,065)
2. Exports Incentives Realized	-	-
3. Fees for Miscellaneous Services	46,95,192	41,62,606
4. Miscellaneous Income	8,24,16,276	6,15,78,706
Total	**8,75,92,935**	**6,51,98,140**

Amount in ₹

Particulars	2023-24	2022-23

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

a) Closing Stock		
Finished Goods	75,61,551	94,42,011
Work-in-progress	86,47,78,000	66,75,39,000
Raw Material	16,29,517	17,21,323
Loose Tools	-	-
Course Material Stock	27,40,320	24,43,138
b) Less : Opening Stock		
Finished Goods	94,42,011	81,26,221
Work-in-progress	66,75,39,000	14,95,56,884
Raw Material	17,21,324	29,73,995
Loose Tools	-	-
Course Material Stock	24,43,138	18,59,044
Total (a-b)	**19,55,63,915**	**51,86,29,328**

Schedule 15 - Establishment Expenses

a) Salaries & Wages	3,44,36,75,561	3,13,90,27,097
b) Allowances & Bonus		
Awards & Prizes	3,70,103	3,61,419
Bonus	-	-
Canteen Facility	3,20,89,914	2,81,64,975
Hire Charges - Contractual Services	28,31,57,539	27,99,78,606
Lease Rent for Employees Quarters	-	-
Leave Travel Concession	93,47,774	2,60,70,446
Medical Reimbursement	17,09,89,921	14,35,04,886
Members Medical & Accident Insurance Expenses	7,09,854	9,30,788
Misc. Allowances and Other Reimbursements	2,97,85,485	2,57,32,529
Staff Recruitment Expenses	56,47,180	83,63,351
Staff Training Expenses	1,02,28,620	48,09,312
Transfer & Relocation Expenses	2,57,520	10,85,832
c) Contribution to Provident Fund	27,03,29,738	24,75,79,222
d) Staff Welfare Expenses	94,16,538	75,74,269
e) Expenses on Employees Retirement and Terminal Benefits	-	-
Gratuity	9,22,26,868	13,03,72,446
Leave Encashment	13,46,60,010	7,90,39,600
Leave Salary & Pension Contribution	4,45,21,068	11,73,50,958
f) Others	-	-
Total	**4,53,74,13,693**	**4,23,99,45,736**

Schedule 16 - Purchases

Purchases	-	-
Hardware Components	2,31,90,77,287	88,35,46,127
Software Components	11,99,70,144	7,65,60,438
Fabrication & In-Fleet Components	61,35,472	61,73,512
Consumables	4,01,15,579	82,63,956
Others	13,85,87,366	57,02,033
	-	-
Total	**2,62,38,85,848**	**98,02,46,066**

Amount in ₹

Particulars	2023-24	2022-23

Schedule 17 - Direct Expenses

Consumables	2,23,12,858	4,09,71,639
Design and Development Charges	-	-
Excise/Custom Duty/Service Tax Paid	13,40,146	9,74,204
Freight and Handling Expenses	11,73,823	7,23,684
Labour Charges	-	9,050
Liquidated Damages	-	-
Material Insurance Expenses	-	-
Other Packing Charges	-	-
Royalty and Support Fees	1,80,000	-
Software Development Consultancy Charges	1,42,59,960	1,30,18,118
Technical Service Charges	1,00,80,23,485	1,07,99,59,867
Warehouse Charges	-	-
Total	**1,04,72,90,272**	**1,13,56,56,562**

Schedule 18 - Expenses on Courses

Advertisement Expenses	1,26,09,954	1,18,42,533
ATC's Share in Fees	24,63,26,134	30,22,25,401
Awards & Prizes	62,688	14,160
Campus Interview Expenses	42,29,152	8,80,925
Course Material Production Expenses	2,08,06,420	2,28,67,610
Data Entry & Scanning Expenses	-	-
Examination Expenses	1,55,02,581	1,48,05,646
Faculty Members Expenses	4,12,69,198	4,95,62,709
Other Course Related Expenses	4,74,60,684	4,33,30,845
Printing of Forms & Prospectus	31,680	392
Students Hostel Expenses	1,50,245	1,05,718
Total	**38,84,48,736**	**44,56,35,939**

Schedule 19 - Other Administrative Expenses

a) Administrative Expenses		
Administrative Charges on Provident Fund	1,60,77,733	1,45,38,481
Asset Hire Charges	33,12,775	66,19,226
Auditors Remuneration	9,54,587	17,38,909
Bank Charges and Commission	27,76,324	2,84,148
C-DAC's Contribution to Funded Projects	28,90,404	8,05,61,767
Cultural Program Expenses	27,73,425	68,58,973
Development Contracts and Spon. Project Expenses	-	-
Electricity, Power and Water Charges	10,80,32,941	8,40,83,640
Entertainment/Hospitality Expenses	62,12,103	39,08,579
Foreign Exchange Fluctuation	(8,096)	(22,915)
Gifts and Presentation	7,46,092	10,58,857
Insurance	33,99,129	29,23,344
Interest Paid	42,51,112	15,49,504
Irrecoverable Balances Written-off/(Written-back)	1,07,76,492	26,33,049
Legal & Professional Charges	1,97,64,227	2,18,49,840
Miscellaneous Expenses	68,15,579	34,76,885
Office Expenses	2,29,12,612	1,92,34,323
Postage, Telephone & Communication Charges	1,67,02,716	1,79,70,566
Printing and Stationery	87,20,839	76,92,138
Provision for Bad and Doubtful Debts/Advances	1,17,88,683	1,96,03,609
Rent, Rates and Taxes	3,11,45,627	2,97,18,592
CGST Paid	2,44,563	-
SGST Paid	2,44,563	1,30,413
IGST Paid	3,60,212	20,655
UTGST Paid	-	-
Reverse Charge GST Paid	-	-
Service Hire Charges	15,38,84,580	11,88,72,070
Subscription of Periodicals & Newspapers	16,45,000	25,12,973
Tender Expenses	8,89,941	31,291
Training Expenses	13,96,591	12,55,073
Transit Quarter & Guest House Expenses	26,60,604	19,10,671
Transportation Charges	1,55,910	1,56,550
Vehicles Hire, Running and Maintenance	1,75,57,498	1,43,79,007

Amount in ₹

Particulars	2023-24	2022-23
b) Repairs and Maintenance		
Air Conditioning Equipments	75,21,033	68,35,910
Building	1,90,01,963	1,45,31,480
Computers	1,12,76,255	1,48,24,105
Electrical Fittings	1,97,68,196	2,67,77,051
Furniture and Fixtures	19,94,566	28,88,695
Garden Maintenance	11,17,674	13,61,478
Lab Equipments	2,57,477	7,51,538
Office Equipments	15,22,565	18,33,571
Other Assets	57,66,294	53,35,363
c) Travelling and Conveyance Expenses	-	-
Inland Travel Expenses	-	-
Director	74,50,823	66,39,276
Members	13,17,99,972	12,16,57,065
Others	40,05,027	32,99,901
Foreign Travel Expenses	-	-
Director	2,79,382	4,55,330
Members	12,24,606	14,14,471
Others	-	25,146
Conveyance Expenses	11,47,430	4,58,876
d) Selling Distribution and Business Promotion Expenses	-	-
Advertisement Expenses	13,52,036	7,89,600
Expenses on Exhibition, Seminars/Workshops	81,87,482	1,34,27,258
Distribution Expenses	1,470	26,101
Product Literature & Brochures Expenses	-	-
Other Sales Promotion Expenses	6,16,198	73,296
e) Other Expenses	-	-
Total Other Administrative Expenses	**68,33,75,215**	**68,89,55,729**

Schedule 20: 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

For M/s. Gogate & Co.(FRN:124144W)
Chartered Accountants

CA Umesh Gogate
Partner (M.No. 109574)
UDIN : 24109574BKFFKJ3117

Date : 8th August, 2024
Place : Pune

Schedule 21: Notes to Accounts

1. Merger of Societies with C-DAC

The Assets, Liabilities and Other obligations at the book value as on 15th December, 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 ₹10,176.02 Lakhs (Previous Year ₹11,757.47 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 ₹1,109.95 Lakhs (Previous Year ₹1,124.75 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 ₹18,029.92 Lakhs (Previous Year ₹29,494.51 Lakhs) and ₹1,989.59 Lakhs (Previous Year ₹6,453.76 Lakhs) grants receivable on account of expenditure incurred in anticipation of release of grants on projects.

4. Contingent Liabilities

4.1. Against Bank Guarantees: ₹1230.89 Lakhs. (Previous Year ₹774.71 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: ₹0.00 Lakhs (Previous Year ₹0.00 Lakhs)
4.5. Against GST: ₹7.97 Lakhs (Previous Year ₹0.00 Lakhs)
4.6. Against Service Tax: ₹11,500.38 Lakhs (Previous Year ₹11,500.38 Lakhs)
4.7. Cases related to staff at various centres are pending at various levels for which liability cannot be assessed.
4.8. Goods and Services Tax Assessments are pending for assessment and therefore liability cannot be assessed. GST is under reconciliation for the FY2023-24.

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	1686.91	14.34	1701.25
Previous Year	32.33	32.03	64.36

6.2 **Expenditure in foreign currency for Travel:** ₹57.21 Lakhs. (Previous Year ₹73.36 Lakhs)
6.3 **Other Expenditure in foreign currency**: ₹785.83 Lakhs (Previous Year ₹151.18 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	693.22
Euro	0.00	0.00
Total Value in ₹ (In Lakhs)	0.00	0.56

7. Remuneration to Statutory Auditors (Including Branch Auditors)

(₹ in Lakhs)

Particulars	Current Year	Previous Year
Audit Fees (Exclusive of GST)	4.15	4.15

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 An amount of ₹3,443.39 Lakhs (Previous Year ₹3,386.95 Lakhs) up to 31st March, 2024, debtors 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 Age wise Analysis of Sundry Debtors as on 31st March, 2024 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	239.85	65.88	15.18	123.28	13.86	458.05
Chennai	589.22	37.11	74.70	9.86	0.59	711.48
Delhi	274.60	23.33	15.15	0.05	208.81	521.94
Hyderabad	155.51	21.59	4.36	2.27	51.01	234.74
Kolkata	301.09	57.22	2.45	0.14	11.78	372.68
Mohali	218.84	41.88	213.52	127.53	104.17	705.94
Mumbai	75.66	37.77	70.40	0.15	714.57	898.55
Noida	3973.02	779.2	906.04	189.58	1097.15	6944.99
Patna	20.30	30.32	6.49	0.00	0.00	57.11
Pune	6974.19	77.66	73.58	161.33	985.7	8272.46
Silchar	168.55	119.55	207.80	0.00	25.09	520.99
Thiruvananthapuram	2472.74	131.11	1603.55	284.15	230.66	4722.21
Total	**15463.57**	**1422.62**	**3193.23**	**898.34**	**3443.39**	**24421.15**
Previous Year	**10056.20**	**1828.03**	**2117.27**	**539.97**	**3386.95**	**17928.42**

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 as per Accounting Standard 12 Accounting for Government Grants.

12. Physical Verification

Reconciliation of physical verification & related reports for FY 2023-24 is in progress and the same will be completed in FY 2024-25.

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. Prior Period Items and Changes in Accounting Policies-AS5

Prior Period Items of Income and Expenses are disclosed in Income and Expenditure account separately and there is no Change in the Accounting Policies during the year 2023-24 as per Accounting Standard 5.

15. Employee Benefits

Employees benefits with respect to Gratuity and Leave encashment has been paid/provided as per provisions of Accounting Standard 15 Employee Benefits based on the actuarial valuation /demand as per policy except as given in notes to accounts of centres.

16. Lease Obligations

Lease rent of ₹172.17 Lakhs (Previous Year ₹158.78 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.

17. Intangible Assets

Reconciliation of the carrying amount at the beginning and end of the periods are reviewed for intangible Assets such as Technical know-how, copy rights and licenses as per Accounting Standard 26 Intangible Assets.

18. 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.

19. 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 14 Accounting for Amalgamations, Accounting Standard 16 on Borrowing Cost, Accounting Standard 18 on Related Party Disclosures, Accounting Standard 22 in respect of Accounting for Taxes on Income and Accounting Standard 27 Financial Reporting of Interests in Joint Ventures are not applicable.

20. Advances paid to employees include ₹0.00 Lakhs as advances paid to Director General (Previous Year ₹0.90 Lakhs).

21. Centre Specific Notes

21.1. Delhi Centre

21.1.1. 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.

21.2. Mumbai Centre

21.2.1. Total outstanding liability in respect of Pension Fund amounting to ₹5,216.15 Lakhs (Previous Year ₹4,784.55 Lakhs), has been provided in the books of accounts as per the Actuarial Valuation. The Fund Value ₹1,189.05 Lakhs plus cumulative Provision ₹4,027.10 Lakhs as on 31st March 2024. There is no shortfall in provision for this year.

21.2.2. 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.

21.2.3. 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 money has been received on 3/6/2022. The total Invoices raised on ECGC Ltd. for the above project is ₹3,300/- Lakhs. No Invoice has been raised during the Current Financial Year.

During the current financial year, C-DAC Mumbai has received ₹.368.64 Lakhs against the total expenditure of ₹1512.71 Lakhs and the net amount of deficit in ECGC Project for ₹1144.07 Lakhs been shown as 'Work-in-Progress" under Other Receivables in Current Assets.

21.2.4. 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 31st March, 2024 have been billed by the centre. The amount equivalent to ₹1851.06 Lakhs (Previous Year ₹1354.54 Lakhs) is available with the Centre as on 31st March, 2024 towards unutilized SMS by the parties. The said amount is transferred to "Advance Received from Party".

21.2.5. The amount received/credited in the Centre's Bank accountsince April 2018 accumulating to Rs.335.50 Lacs has not been recognized,of which the amount accumulated for more than 2 years for Rs.133.49 lacs has been transferred to 'Miscellaneous Income' during the current financial year. Hence, the total amount unrecognized amount of Rs. 202.01 lacs has not been accounted in the books as on 31/3/2024. The said amount is shown under "Funds Received (Untraceable) MEGD A/c" under Other Current Liabilities.

21.3. **Noida Centre**

21.3.1. In respect of Business Development Division, Chandigarh –VAT Assessment has been completed up to AY 2010-11. An amount of ₹3.26 Lakhs has been deposited under protest on dated 26th February, 2020 against demand of ₹13.07 Lakhs for non-consideration input credit. During the FY 2023-24, the case has been disposed off with "NIL" demand vide order dated 30-6-2023. Refund of ₹ 3.26 Lakhs is under process from the Department.

21.4. **Pune Centre**

21.4.1. "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.

21.4.2. No provision is made for the Advances to employees against various claims amounting to ₹31.49 Lakhs (Previous Year ₹35.16 Lakhs), which will be booked in the FY 2023-24. As most of the claims will directly be debited to the Projects / Grants.

21.4.3. During the FY 2023-24, C-DAC, Pune adjusted ₹ 85.68 Lakhs from Corpus amount. This amount was very old amount receivable from C-DAC, Hyderabad.

21.4.4. As on 31st March 2024, the books of accounts showing an amount of ₹8616.80 Lakhs towards WIP with respect to Construction of CIP Building and Chikhli land.

21.5. **Thiruvananthapuram Centre**

21.5.1. 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.

22. Inter unit /Inter Centre Sales(Purchases)

Inter unit/ Inter Centre Sales and Purchases is showing "Nil" Lakhs (Previous Year ₹4.75 Lakhs) as per Schedule-9 (Net of Sales and Purchases between the C-DAC Centres).

23. The Consolidated Financials i.e., Consolidated Balance Sheet and Consolidated Income & Expenditure Account are prepared based on the Audited Annual Accounts received from the Centres.

24. Centre wise Financial Performance is attached as Schedule 21-A and Centre wise details of Assets and Liabilities, Income & Expenditure is attached as Schedule 21-B.

25. Current Year figures from the 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.

26. 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

For M/s. Gogate & Co.(FRN:124144W)
Chartered Accountants

CA Umesh Gogate
Partner (M.No. 109574)
UDIN : 24109574BKFFKJ3117

Date : 8th August, 2024
Place : Pune

FINANCIAL PERFORMANCE OF C-DAC FOR THE FINANCIAL YEAR 2023-24 as per AS17:SEGMENT REPORTING

Schedule 21-A:

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

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**	**(824.51)**													
	GIA General	300.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.87	294.37	0.00	0.00	0.00
	Core Grant Projects	(1124.77)	0.00	0.00	0.00	(1109.95)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(14.80)
(ii)	**Grant for Sponsored Projects**	**23040.75**													
	MeitY	(2968.08)	(322.47)	(92.99)	0.00	(40.68)	601.40	0.00	(61.71)	(167.01)	154.66	0.00	(4027.49)	0.00	988.21
	Other Agencies	26008.83	18.16	0.00	0.00	1114.49	87.42	149.93	2934.66	112.77	289.11	0.00	20780.77	0.00	521.52
B	**RECEIPTS & INCOME**														
(i)	**Grant -in- Aid**	**27000.00**													
	GIA General	27000.00	3282.94	1142.42	1048.82	474.83	764.25	968.55	1252.50	1905.57	2212.50	259.30	8874.75	245.57	4568.00
	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)	**Grant for Sponsored Projects**	**92873.41**													
	MeitY	60375.53	3614.74	132.46	0.00	302.42	2850.58	886.44	1367.48	1993.44	4930.12	460.98	35170.78	0.00	8666.08
	Other Agencies	32497.88	49.15	0.00	0.00	241.50	439.36	93.97	1170.49	23.62	370.67	0.00	29782.85	0.00	326.27
(iii)	**Revenue Earnings**	**84439.00**													
	Training	17256.11	595.42	33.24	0.00	105.25	321.76	16.56	207.25	578.00	2246.81	6.59	12875.90	0.29	269.04
	Commercial	67182.89	1314.64	3522.24	0.00	420.70	2619.86	589.01	1166.16	3951.86	11541.32	105.50	31102.36	323.77	10525.47
(iv)															
	Interest, Other Income & C-DAC Contribution	**466.85**													
	GIA General	388.67	0.00	0.00	0.00	0.00	0.00	(0.01)	0.00	1.68	0.00	387.00	0.00	0.00	0.00
	Core Grant Projects	78.18	0.00	0.00	0.00	63.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.80
		541.81													
	MeitY Spon Projects	127.81	0.00	0.00	0.00	0.00	102.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.46
	Spon. By Other Agencies	414.00	0.00	0.00	0.00	0.00	9.43	0.07	68.20	2.64	0.08	0.00	332.71	0.00	0.87
		8232.08													
	Training	1994.62	98.40	6.51	77.76	1.15	59.37	1.15	317.39	0.00	710.11	6.46	690.21	0.00	26.11
	Commercial	6237.46	82.02	77.54	211.29	92.97	193.93	152.62	27.85	176.55	1270.71	24.45	994.47	0.41	2932.65
	TOTAL (A+B)	**235769.39**	**8733.00**	**4821.42**	**1337.87**	**1666.06**	**8049.71**	**2858.29**	**8450.27**	**8579.12**	**23731.96**	**1544.65**	**136577.31**	**570.04**	**28849.68**
C	**REVENUE Expenditure**														
(i)	**Expenditure from Grant-In-Aid**	**26893.21**													
	GIA General	**26893.21**													
	Establishment Expenses	24252.38	2950.00	1000.00	781.00	375.00	658.75	798.20	1162.50	1550.00	2100.00	511.68	8035.00	171.25	4159.00
	Other Administrative Expenses	2640.83	300.00	110.50	248.75	57.90	70.50	65.50	90.00	189.50	112.50	140.83	839.75	36.10	379.00
	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**	**65936.57**													
	MeitY Total Expenses	**41139.06**													
	Establishment Expenses	13248.18	878.81	9.37	0.00	218.40	883.50	524.72	283.67	1142.04	1710.36	173.30	4301.21	0.00	3122.80
	Other Administrative Expenses	27890.88	2105.96	30.10	0.00	55.95	412.90	336.26	665.40	496.24	2349.40	89.09	20158.73	0.00	1190.85
	Other Agencies Total Expenses	**24797.51**													
	Establishment Expenses	3615.95	29.68	0.00	0.00	113.27	567.77	139.57	1304.94	107.78	446.89	0.00	704.79	0.00	201.26
	Other Administrative Expenses	21181.56	19.63	0.00	0.00	292.61	172.17	28.09	2079.05	23.59	73.08	0.00	18365.50	0.00	127.84
(iii)	**Other Revenue Expenditure**	**67414.27**													
	Training Total Expenses	**11805.60**													
	Establishment Expenses	2409.02	56.93	14.76	0.00	47.53	133.69	13.27	148.41	146.22	844.64	10.22	731.38	0.76	261.21
	Other Administrative Expenses	9396.58	201.62	21.73	43.19	70.32	69.63	13.05	98.29	95.29	462.15	16.69	8197.34	1.18	106.10
	Commercial Total Expenses	**55608.67**													
	Establishment Expenses	18712.74	0.00	738.91	62.04	203.71	633.25	910.87	765.51	1615.55	4917.61	21.87	5062.49	226.98	3553.95
	Other Administrative Expenses	36895.93	65.28	1301.40	46.67	192.29	1447.55	308.98	128.16	2133.98	1191.47	13.80	23468.80	56.73	6540.82
	TOTAL C	**160244.05**	**6607.91**	**3226.77**	**1181.65**	**1626.98**	**5049.71**	**3138.51**	**6725.93**	**7500.19**	**14208.10**	**977.48**	**89864.99**	**493.00**	**19642.83**

FINANCIAL PERFORMANCE OF C-DAC FOR THE FINANCIAL YEAR 2023-24 as per AS17:SEGMENT REPORTING

Schedule 21-A:

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

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**	**572.75**													
	GIA General	509.37	32.94	31.92	19.07	41.93	35.00	104.84	0.00	166.07	(0.04)	9.42	0.00	38.22	30.00
	Core Grant Projects	63.38	0.00	0.00	0.00	63.38	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.**	**9445.86**													
	MeitY	8598.46	551.41	0.00	0.00	0.00	682.71	25.43	38.90	232.51	290.73	191.26	2624.13	0.00	3961.37
	Other Agencies	847.40	0.00	0.00	0.00	0.00	190.79	1.50	58.21	1.33	8.35	0.00	564.20	0.00	23.03
(iii)	**Expenditure from Own Funds**	**2624.79**													
	Training	568.65	359.53	0.00	0.00	1.22	18.68	5.44	5.05	8.07	35.86	0.00	124.26	0.00	10.54
	Commercial	2056.14	0.00	39.50	0.00	3.90	0.00	176.84	26.48	149.06	957.53	10.76	228.76	0.38	462.94
	TOTAL D	**12643.40**	**943.88**	**71.42**	**19.07**	**110.43**	**927.18**	**314.05**	**128.64**	**557.04**	**1292.43**	**211.44**	**3541.35**	**38.60**	**4487.88**
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**	**25033.19**													
	MeitY	4624.69	156.11	0.00	0.00	0.03	1125.46	0.04	323.00	0.00	718.88	7.33	1957.33	0.00	336.51
	Other Agencies	20408.50	4.55	0.00	0.00	493.44	65.28	0.00	732.22	3.03	17.17	0.00	19088.19	0.00	4.62
	TOTAL (E)	**25033.19**	**160.66**	**0.00**	**0.00**	**493.47**	**1190.74**	**0.04**	**1055.22**	**3.03**	**736.05**	**7.33**	**21045.52**	**0.00**	**341.13**
F	**TOTAL Expenditure (C+D+E)**	**197920.64**	**7712.45**	**3298.19**	**1200.72**	**2230.88**	**7167.63**	**3452.60**	**7909.79**	**8060.26**	**16236.58**	**1196.25**	**114451.86**	**531.60**	**24471.84**
G	**Unspent Balance / Surplus / Deficit (A+B-F)**														
(i)	**Grant -in- Aid**	**(823.62)**													
	GIA General	286.33	0.00	0.00	(0.00)	(0.00)	0.00	(0.00)	0.00	1.68	5.91	278.74	0.00	(0.00)	0.00
	Core Grant Projects	(1109.95)	0.00	0.00	0.00	(1109.95)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(ii)	**Sponsored Projects**	**16040.33**													
	MeitY	3173.06	(400.02)	0.00	0.00	(12.64)	449.76	(0.01)	(5.20)	(44.36)	15.41	(0.00)	2101.89	0.00	1068.22
	Other Agencies	12867.27	13.45	0.00	(0.01)	456.67	(459.80)	74.81	(1.07)	3.30	114.37	0.00	12173.65	0.00	491.91
(iii)	**Other**	**25256.86**													
	Training	7445.17	435.27	3.26	34.58	(11.45)	177.81	(8.60)	277.94	336.50	1650.14	(13.85)	4637.38	(1.65)	(72.16)
	Commercial	17811.68	1331.38	1559.47	102.58	117.67	732.99	(478.22)	300.34	378.88	6702.95	94.28	3565.54	40.47	3363.35

Schedule 21-B:

CENTRE WISE BALANCE SHEET AS AT 31st March 2024

(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	1,05,690.23	6,561.25	3,196.59	3,789.62	2,669.74	6,230.90	857.31	7,383.97	(1,713.45)	33,117.41	376.93	33,314.79	1,157.94	8,747.23
Reserves and Surplus	38,954.18	677.51	93.12	30.03	2,997.03	1,726.77	373.25	420.59	653.40	1,187.67	332.86	18,261.80	49.59	12,150.57
Earmarked and Endowment Funds	15,290.35	(384.53)	1.17	-	(665.32)	(10.03)	74.80	(6.29)	(37.98)	135.69	278.74	14,343.96	-	1,560.13
Secured / Unsecured Loan from Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Current Liabilities and Provisions	77,014.11	1,181.47	148.76	273.83	215.24	354.96	2,490.02	822.87	6,879.48	5,150.95	57.14	20,026.89	152.46	39,260.05
Branch & Divisions	0.00	206.52	(71.34)	(353.42)	148.89	(117.10)	690.12	(1,133.40)	17.86	(1,045.46)	49.99	1,323.02	(742.40)	1,026.73
Total	**2,36,948.87**	**8,242.22**	**3,368.29**	**3,740.06**	**5,365.58**	**8,185.49**	**4,485.49**	**7,487.75**	**5,799.30**	**38,546.26**	**1,095.65**	**87,270.46**	**617.59**	**62,744.71**
ASSETS														
Fixed Assets														
Acquired out of Own Funds	6,069.46	661.89	31.44	-	287.38	82.27	187.38	123.53	296.07	2,083.20	9.15	1,690.79	9.93	606.43
Acquired out of Grant in Aid	17,887.48	148.88	42.81	30.03	2,997.00	746.98	246.54	70.39	264.85	268.88	218.10	8,632.63	49.59	4,170.80
Acquired out of Project Grants	21,066.70	528.62	50.31	-	0.03	979.79	126.71	350.20	388.56	918.78	114.76	9,629.17	-	7,979.77
Investments-from Earmarked/Endowment Funds	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Investments-Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Current Assets, Loans, Advances etc.	1,91,925.23	6,902.83	3,243.74	3,710.03	2,081.17	6,376.45	3,924.86	6,943.62	4,849.83	35,275.39	753.65	67,317.88	558.07	49,987.71
Miscellaneous Expenditure	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**2,36,948.87**	**8,242.22**	**3,368.29**	**3,740.06**	**5,365.58**	**8,185.49**	**4,485.49**	**7,487.75**	**5,799.30**	**38,546.26**	**1,095.65**	**87,270.46**	**617.59**	**62,744.71**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CENTRE WISE INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st March 2024

Amount in Lakhs

Particulars	Total	Bangalore	Chennai	Corporate	Delhi	Hyderabad	Kolkata	Mohali	Mumbai	Noida	Patna	Pune	Silchar	TVM
INCOME														
Income from Sales/Services	75,380.12	1,297.95	3,522.24	-	481.01	2,619.86	588.65	1,208.41	3,951.86	12,628.56	105.36	38,115.88	323.77	10,536.58
Grants/Subsdies	26,877.58	3,250.00	1,110.50	1,029.75	432.90	729.25	863.71	1,252.50	1,739.50	2,212.50	636.88	8,874.75	207.35	4,538.00
Fees/Subscription	9,058.89	612.11	33.24	-	44.93	321.76	16.92	165.01	578.00	1,159.57	6.74	5,862.38	0.29	257.94
Interest Earned	5,539.27	188.75	84.05	193.94	85.87	226.89	131.91	303.93	30.51	1,646.41	30.37	1,913.33	0.36	702.95
Other Income	875.95	0.50	0.01	95.12	1.84	9.76	21.86	6.77	147.52	285.60	0.54	25.38	0.05	281.00
Prior Period Income	(137.06)	-	-	-	6.41	16.65	-	34.53	0.21	48.82	-	(245.68)	-	2.00
Goods and Work-in-progress	1,955.64	(8.82)	-	-	-	-	-	-	-	-	-	(8.35)	-	1,972.81
Total	**1,19,550.39**	**5,340.49**	**4,750.04**	**1,318.81**	**1,052.97**	**3,924.17**	**1,623.04**	**2,971.15**	**6,447.60**	**17,981.46**	**779.89**	**54,537.69**	**531.82**	**18,291.27**
EXPENDITURE														
Establishment Expenses	45,374.14	3,006.93	1,753.68	843.04	626.23	1,425.69	1,722.34	2,076.42	3,311.77	7,862.25	543.77	13,828.87	398.99	7,974.16
Purchases	26,238.86	4.06	-	-	-	1,325.65	-	61.35	22.87	-	-	20,989.94	-	3,834.99
Direct Expenses	10,472.90	0.42	985.27	38.45	-	2.97	37.09	20.64	1,651.55	105.14	14.88	5,837.77	20.24	1,758.47
Expenses on Courses	3,884.49	39.54	9.76	-	24.40	8.70	6.45	23.06	47.38	366.28	11.91	3,289.82	0.43	56.75
Other Administrative Expenses	6,833.75	361.28	423.05	295.42	267.18	222.46	275.63	176.74	558.88	759.87	142.91	2,148.51	68.54	1,133.28
Prior Period Expenses	110.87	-	0.45	4.74	6.45	1.65	-	0.24	68.71	49.04	-	(20.95)	-	0.54
Depreciation (corresponding to Schedule 5)	1,392.47	161.60	15.11	-	22.48	26.25	68.36	34.41	69.38	485.78	1.61	260.81	4.80	241.88
Total	**94,307.48**	**3,573.83**	**3,187.31**	**1,181.65**	**946.74**	**3,013.37**	**2,109.87**	**2,392.87**	**5,730.54**	**9,628.37**	**715.09**	**46,334.76**	**493.00**	**15,000.08**
Transferred to / (from) Balance of Core Grants	(13.95)	-	-	-	-	-	-	-	1.68	-	(15.63)	-	-	-
SURPLUS / (DEFICIT)	**25,256.86**	**1,766.65**	**1,562.73**	**137.16**	**106.22**	**910.80**	**(486.82)**	**578.28**	**715.38**	**8,353.09**	**80.43**	**8,202.92**	**38.82**	**3,291.19**

CONSOLIDATED RECEIPTS AND PAYMENTS FOR THE YEAR ENDING 31st March 2024

Amount in ₹ *Amount in ₹*

Receipts	2023-24	2022-23	Payments	2023-24	2022-23
I. Opening Balance			**I. Expenses**		
a) Cash on hand	222	8,921	a) Establishment Expenses	1,78,41,78,749	1,37,13,36,951
b) Bank Balances			b) Administrative Expenses	1,26,74,64,379	1,15,83,39,697
i) In Savings/Current Accounts	4,85,70,97,587	5,03,36,62,034	c) Payment made to Creditors for Goods and Others	7,66,41,48,619	4,61,85,79,526
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)	2,37,00,20,179	8,63,93,71,791
a) From Government of India	2,94,93,67,986	2,07,56,77,090			
b) Grant and Other Income Received for Projects	8,32,14,96,120	5,95,20,14,044	**III. Investments and Deposits made Progress**	7,11,74,88,458	12,72,10,64,421
III. Income from Encashment of FDRs	5,28,16,12,795	18,41,28,13,219			
IV. Interest Received			a) Purchase of Fixed Assets	19,00,32,010	19,35,35,873
a) On Bank Deposits	31,02,63,927	46,55,17,771	b) Expenditure on Capital Work in Progress	69,61,763	92,01,466
b) Loans and Advances	1,65,68,432	(1,49,70,762)	**V. Refund of Surplus money/loans**	-	-
V. Other Income (Specify)			**VI. Finance Charges (Interest)**	-	-
a) Previous years Income recovered	48,82,200	22,39,490	**VII. Other Payments (Specify)**	-	-
b) Advances Received from Customers	2,87,15,37,410	29,57,42,297	a) Deposit (Assets)	36,30,72,009	31,40,26,312
d) Fees/Subscription & Direct Income	1,33,86,53,171	1,68,61,19,005	b) Loans and Advances	27,29,53,703	73,05,62,091
e) Other Income	1,16,71,02,377	1,04,81,60,388	c) Previous years outstanding payments	6,68,95,18,009	4,91,75,42,446
f) Amount Received from Debtors	5,01,21,70,879	3,30,59,22,636	d) Prepaid Expenses	5,46,56,296	1,84,59,580
g) Loans and Advances Recovered	42,11,65,236	1,16,63,72,414	e) Branch and Divisions	4,19,59,71,536	4,07,15,24,011
VI. Amount Borrowed			f) Deposits (Liabilities) Refunded	16,72,63,490	10,83,94,592
Branch and Divisions	3,62,65,50,061	3,85,40,75,090	**VIII. Closing Balance**		
Bank Loan	-	2,60,527			
VII. Any Other Receipt (Give Details)			a) Cash on hand	259	222
a) Deposits (Liabilities)	(12,29,49,768)	41,28,72,402	b) Bank Balances		
b) Addition to Reserve Fund	-	-	i) In Savings Accounts	3,95,04,89,176	4,85,70,97,587
Total	**36,09,42,18,635**	**43,72,90,36,566**	**Total**	**36,09,42,18,635**	**43,72,90,36,566**

AS PER OUR REPORT OF EVEN DATE
FOR AND ON BEHALF OF
M/S. Gogate & Co. (FRN: 124144W)
Chartered Accountants

Indira Pasupathy
Director Finance

Sunil Misar
Registrar (I/C)

Magesh Ethirajan
Director General

CA Umesh Gogate
Partner (Membership No.109574)
UDIN: 24109574BKFFKJ3117
Place : Pune , Date : 8th August, 2024

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C-DAC/Corporate Office/Annual Report 2024

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