# techzine

## C-DAC R&D DIGEST

JANUARY 2024- MARCH 2024
VOLUME 1, ISSUE 4


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# Message from **Director General**

Techzine R&D Digest is fostering a culture of excellence in research, innovation, and knowledge dissemination within C-DAC. I congratulate Corporate R&D team on the release of the fourth issue of C-DAC's Techzine R & D Digest and best wishes for continued success in promoting collaboration and creativity within C-DAC and among stakeholders.

I am happy to know that the current issue of Techzine focuses on healthcare and its applications, which provide a glimpse of latest advancements in healthcare technology. C-DAC has developed several technologies and software/hardware solutions in healthcare domain ranging from telemedicine solutions, Hospital Management Information System, Mobile Healthcare Solutions, EMR System for Cancer care and Oncology, etc. After going through the inspiring insight section of the digest, I am sure that readers will gain deeper insights into the cutting-edge developments which shape the future of healthcare technologies, patient care, and overall industry landscape.

I am proud of the remarkable work being done by all the teams across C-DAC and their unwavering dedication to excellence. Together, we are building a culture of innovation that values collaboration, creativity, and the relentless pursuit of excellence.

We should march the path ahead, inspiring others to join us in this journey of discovery through Techzine, to share the knowledge and expertise, and to contribute in collective advancement.

Shri Magesh Ethirajan

# Message from
# **Editorial Board**

We are happy to see that all three issues Techzine has helped to proliferate the research, development, and successful usage of applications across various Ministries including MeitY, academia, research institutions and industries and other stakeholders. Each issue of our Techzine seeks to showcase the incredible work being done by C-DAC researchers and innovators around the all C-DAC centres. we extend our warmest greetings to all of you, our esteemed readers and contributors.

This issue of Techzine focuses on healthcare domain having multiple articles on Innovating Telemedicine: Charting New Frontiers with AI-Driven ePrescription Audits in eSanjeevani, Tranquil Chill with Mindful Quill, Revolutionizing Healthcare: Cutting-Edge Applications and Clinic Management Software Solutions and Healthcare -The Transformation.

Thank you for your continued support, and we look forward to embarking on this journey with you.

Editorial Board

- Shri Pramod P. J., Scientist F, Head – Corporate R&D, C-DAC
- Shri Manoj Gopinath, Head M&C, Associate Director, C-DAC Pune
- Shri Shripad Shriram Kalambkar, Scientist E, Corporate R&D, C-DAC
- Shri Anant Kelkar, Manager, Corporate R&D, C-DAC
- Shri Sanjay Chakane, Admin Officer, Corporate R&D, C-DAC

# IDEAS TO ACTION

NEW MEITY PROJECTS

# IDEAS TO ACTION

1



**Name of Project:** AI for Cybersecurity (AI4CS)

**CI:** Mr. Ramesh Naidu Laveti, C-DAC Bengaluru
Dr. Balaji Rajendran, C-DAC Bengaluru

**Co-CI:** Mr. Gopinath P, C-DAC Bengaluru

**Collaborators:** SETS-Chennai, IIT-Madras, IIT-Jodhpur and IIT-Delhi

**Brief Description:** "AI for Cybersecurity (AI4CS)" is a distributed node encompassing R & D labs, reputed academic institutes and industries as a team to a) Perform R&D and develop a framework to dynamically fine-tune the robustness of an AI model against a set of attacks with respect to the application requirements. Recommend newer approaches for the detection of adversarial attacks related to Domain Generation Algorithms (DGA), Ransomware and Differential Privacy. b) Develop tools using AI to provide quick evaluation of side-channel leakage vulnerability in an AI-CS application and provide solutions that can be incorporated in compilers to enable targeted countermeasures. c) Collect datasets - text, image, audio, video and network data corresponding to real and misinformation class. Design algorithm to detect whether given text, image, video, audio data is real or fake and also design the network analysis tool to predict and analyse the network of misinformation propagation. d) Develop a toolkit for differentially private Machine Learning (ML) and develop toolkits of cryptographic techniques which ensure confidentiality and integrity of the ML process. e) Investigate techniques based on emerging edge-AI hardware for cyber-security use-cases (i.e., energy efficient hardware such as beyond-CMOS devices, memristors, phase change memory, magneto-resistive, resistive memory etc.). f) Incubate start-ups to promote and improve the R&D prototypes developed as the part of AI4CS project.

NEW MEITY PROJECTS

# IDEAS TO ACTION

2

**Name of Project:** A Comprehensive IoT Security Ecosystem and Sandbox

**CI:** Mr. Haribabu P., C-DAC Bengaluru

**Co-CI:** Dr. Balaji Rajendran, C-DAC Bengaluru
Dr. Mohammed Misbahuddin, C-DAC Bengaluru
Dr.Muraleedharan, C-DAC Bengaluru
Mr.Raghavendra S Patil, C-DAC Bengaluru
Mr. Gopinath P, C-DAC Bengaluru
Mr. Kaushik Nanda, C-DAC Bengaluru

**Collaborators:** IIT Bhubaneswar

**Brief Description:** The core objective of this project is segregated in to two parts, 1) Design and development of a comprehensive IoT security ecosystem addressing the issues related to the device, network, and data security. 2) Design and development of multiple indigenous modules for functionally and security validation and establishment of a physical IoT sandboxing facility at Bengaluru.

NEW MEITY PROJECTS

# IDEAS TO ACTION

3



**Name of Project:** Implementation of ISO 27001 for Web Trust Compliance for Root Certifying Authority of India

**CI:** Mr. Gokulatheerthan M, C-DAC Bengaluru

**Co-CI:** Dr. Balaji R, C-DAC Bengaluru
Mr. Praveen Ampatt, C-DAC Bengaluru

**Brief Description:** The project focuses on implementing ISO 27001 standards to ensure compliance with Web Trust requirements for the Root Certifying Authority of India. It aims to (i) Establish and maintain a robust security framework that ensures the confidentiality, integrity, and availability of CCA operations and the digital certificates it issues. (ii) Ensure compliance with relevant industry standards and regulations, such as the CA/Browser Forum's Baseline Requirements and the WebTrust for CA program. (iii) Maintain and enhance the trustworthiness of the CA by demonstrating adherence to industry best practices and security standards. (iv) Implement controls and risk mitigation. This will ensure compliance with ISO 27001 and Web Trust requirements to maintain trust and confidence in the integrity of the digital certificate infrastructure.

NEW MEITY PROJECTS

# IDEAS TO ACTION

4



**Name of Project:** Blockchain-Based Digital Signature Certificate Validation and Storage System

**CI:** Mr. Anoop Kumar Pandey, C-DAC Bengaluru

**Co-CI:** Dr. Balaji R, Associate Director, C-DAC Bengaluru
Ms. Jyostna Grandhi, C-DAC Hyderabad

**Brief Description:** The objective of the project is to develop a Blockchain-based Digital Signature Certificate (DSC) Validation and Storage System to (i) Validate the DSC before its issuance by the CA; (ii) Record the DSC in a Blockchain-based ledger with distributed nodes and the corresponding smart contract; (iii) Verify a DSC stored in the Blockchain ledger on request. This will improve the overall integrity and transparency of the PKI Ecosystem.

NEW MEITY PROJECTS

# IDEAS TO ACTION

5

**Name of Project:** Design and Development of indigenous, cost-effective Autonomous Tractor, for Indian Farming Conditions and Applications (A-TRACT)

**CI:** Mr. Jerry Daniel, C-DAC Thiruvananthapuram

**Co-CI:** Mr. Santosh Sam Koshy, C-DAC Hyderabad
Ms. B. Vijayalakshmi, C-DAC Hyderabad

**Collaborators:** IIT Palakkad, Mahindra & Mahindra (Industry Partner)

**Brief Description:** The project envisages the design and development of technologies and system components for an indigenous and cost-effective Autonomous Tractor, specifically for Indian farming conditions. It is envisaged to develop a SAE J3016 Level 3 autonomous tractor with scalable and robust system components like Autonomous Controller for Tractor System, Autosteer System, Auto Brake System, Auto Implement Lift and Draft System and Automated Traversals in Agricultural Fields. The developed components will be integrated in a tractor provided by Mahindra & Mahindra, and specific traversals and farm management practices will be demonstrated in orchard and open farms applications targeting vineyards, potato and maize crops. The Autonomous Tractor will seek to ease and improve the crop management processes, operation time, precision input and overall efficiency of the farming operations, with the aim of translating into economic benefits for the farmer.

NEW MEITY PROJECTS

# IDEAS TO ACTION

6





**Name of Project:** Development of PKI-based Digital Certificates for IoT Device Security with PoC showcasing use-cases such as (i) Smart City, (ii) Unmanned Aerial Vehicles (UAVs) i.e., Drone, and (iii) Automotive Industry.

**CI:** Dr. Mohammed Misbahuddin, C-DAC Bengaluru
Mr Santosh Sam Koshy, C-DAC Hyderabad

**Co-CI:** Mr Mahesh U. Patil, C-DAC Hyderabad
Dr. P. R. Lakshmi Eswari, C-DAC Hyderabad
Dr. Balaji Rajendran, C-DAC Bengaluru
Mr. Shrikrishna S Chippalkatti, C-DAC Bengaluru

**Collaborators:** SETS Chennai

**Brief Description:** Standards for vehicular communication have been evolving since the past decade. The communication stacks of V2X systems have been specified by IEEE in its 1609.x family of standards and by ETSI in its Cooperative Intelligent Transportation Systems (C-ITS) suite of standards. In these stacks, special provisions have been made for security and privacy of the communication between vehicles and infrastructure. In 2020 the IEEE 1609.2 standard was amended with a conceptual reference architecture titled Security Credential Management System (SCMS), which deals with certificate management interfaces for end entities, based on PKI infrastructure. Similarly, the ETSI specifies security requirements for vehicular communication environments in its standard TS 133-185 and the implementation detail of these requirements is conveyed through the TS 102-941 standard. Some significant deviations from conventional certificate management systems, as specified by the standards, are due to the operational requirements of the automotive domain, listed above. This calls for departure from traditional approaches used in authenticating web applications, while incorporating automotive specific requirements into the existing CA infrastructure.

NEW MEITY PROJECTS

# IDEAS TO ACTION

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**Name of Project:** Smart City 2.0 Empowering Indian Industry with Smart Solution

**CI:** Mr. Hari Babu P., C-DAC, Bengaluru

**Co-CI:** Mr. Kaushik Nanda, C-DAC Bengaluru
Mr. Jitesh Choudhury, C-DAC Silchar
Mr. Devadatta Sasmala, C-DAC, Delhi
Dr. S. V. Srikanth, C-DAC, Hyderabad

**Collaborators:** IIT Bhubaneswar

**Brief Description:** The main objective of this project is to develop industry oriented innovative systems and solutions to complement the national initiatives like Atmanirbhar Bharat, Make in India, Digital India, Smart city mission and AMRUT2.0. This project emphasizes on productization of the systems/solutions developed under the first phase of the smart city project, development of new technologies and facilitation of the Indian industries/start-ups to develop multiple innovative solutions through the dedicated industry support centres. Industry encouragement through a set of grand challenges and industry support programmes are also included in this project.

NEW MEITY PROJECTS

# IDEAS TO ACTION

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**Name of Project:** Centre for Promotion of Additive Manufacturing- Agri & Food Processing

**CI: Dr.** Alokesh Ghosh, C-DAC Kolkata

**Co-CI:** Dr. Hena Ray, C-DAC Kolkata
Dr. Amitava Akuli, C-DAC Kolkata
Dr. Arun Jana, C-DAC Kolkata
Dr. Subhankar Mukherjee, C-DAC Kolkata
Dr. Subrata Sarkar, C-DAC Kolkata

**Collaborators:** Central Manufacturing Technology Institute (CMTI), Bengaluru, CSIR-Central Food Technological Research Institute (CFTRI) Mysore, IIM Calcutta Innovation Park (IIM-CIP), Kolkata

**Brief Description:** The objective of this project is to set up an Agri-Factory, which is utilized for the supply chain management process of vertically farmed agricultural produce specifically Potato (Solanum tuberosum) produced by aeroponics technology and then these mashed potatoes are used as raw material for 3D printed additive manufactured customized, nutrient optimized edible agro-products, food products, and medicinal food. This Agri-Factory will help produce potato-based customized, nutrient-optimized edible agro-products, which will help Indian farmers compete at a global level using this technology.

NEW MEITY PROJECTS

# IDEAS TO ACTION

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**Name of Project:** National Programme on Electronics and ICT Applications in Agriculture and Environment (AgriEnIcs)

**CI:** Dr. Alokesh Ghosh, C-DAC Kolkata

**Co-CI:** Dr. Hena Ray, C-DAC Kolkata
Dr. Amitava Akuli, C-DAC Kolkata

**Collaborators:** NDRI, Kalyani, IIT, Kharagpur, Nature Dairy, Elexon Technologies LLP, ICAR, New Delhi, R.S. Enterprises, CIPHET, Ludhiana, SKAUST, Kashmir, NUGENIX, North Fresh Agro Cold Chain Pvt. Ltd.,La Machinotech, Directorate of Poultry Research, Hyderabad, Quality Thought Technologies, Hyderabad, IIT (ISM), Dhanbad, JM Environtech

**Brief Description:**
Projects under this are:

- Electronic Platform to Monitor Cattle Health and Milk Quality
- e-Quality – Electronic Quality Assessment Solution for Agricultural Commodities for National Agricultural Market (e-NAM)
- Vision-guided AI-enabled Robotic Apple Harvester
- IoT Solution for Smart Poultry Farm practice
- AI-based Air Quality Monitoring System (AQAIMS) for Cement Industries and mine.

NEW MEITY PROJECTS

# IDEAS TO ACTION

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**Name of Project:** TULIP: Tea Harvesting Unmanned Robotic Platform For Northeast Indian Tea Plantation

**CI:** Dr. Alokesh Ghosh, C-DAC Kolkata

**Co-CI:** Dr. Hena Roy, C-DAC Kolkata

**Collaborators:** Jadavpur University, Kolkata, TRA, Jorhat, CIAE Bhopal, And Industry Partner: Tea Research Association, Kolkata, Moog Motion Control Pvt. Ltd, Bengaluru and SVR InfoTech, Pune

**Brief Description:** The objective of this project is to develop an autonomous low-cost robotic harvester to improve the working conditions of farmers during small and medium-scale tea harvesting on tea plantations with the following attributes:

- A remote-controlled/self-driven robotic platform (Electro-hydraulic driven vehicle)
- Equipped with multi-sensor and actuator for harvesting tealeaves in rough terrain.
- Storage and handling of harvested leaves through mechanical blower.
- AI-based vision for identification, actuation, and Crop health monitoring
- Application of hydraulic Tipper for emptying storage.
- Software framework with GUI on ROS platform.
- Selectivity of tea shoots to be plucked for quality.

NEW MEITY PROJECTS

# IDEAS TO ACTION

11




**Name of Project:** Development of Next Generation Honeypot Technologies and Sharing of Cyber Threat Intelligence

**CI:** Dr. Sanjeev Kumar, C-DAC Mohali

**Co-CI:** Mr. Saurabh Chamotra, C-DAC Mohali
Mr. Peeyush Jain, C-DAC Mohali
Mr. Anil Kumar, C-DAC Mohali

**Collaborators:** National Cyber Coordination Centre (NCCC)/ CERT-In

**Brief Description:** The overall goal of the project is development of next generation honeypot technologies for proactive cyber threat management and generation of cyber threat intelligence in actionable formats. The research, development and deployment of latest honeypots including ICS, IoT/IIoT, IPv6, Cloud honeypots, High Interaction etc. will be carried out as a part of this project along the expansion and scaling of the existing honeypot infrastructures. Further, the research and development of indigenous threat analytics engines such as malware analytics platform, early warning system, heuristics, and signature-based threat detection as well as integration of the commercial analysis platforms are envisaged to generation and disseminate the accurate cyber threat intelligence in near real-time.

NEW MEITY PROJECTS

# IDEAS TO ACTION

12

**Name of Project:** Crowd Sourcing Analytics on Social Media Platforms

**CI:** Dr. Mary Jacintha, C-DAC Noida

**Brief Description:** The project is to study and analyze the issues in social media contents by gathering data from various social media platforms (Twitter, Facebook, Telegram, Instagram etc.) using API's and data scrapping techniques. The project will help to report emerging trends and threats related to misinformation, disinformation, fake news and fact checking along with customizable dashboards for user specific needs.

NEW MEITY PROJECTS

# IDEAS TO ACTION

13

**Name of Project:** Implementation of a resilient industrial green energy micro grid

**CI:** Mr Brijesh P, C-DAC, Thiruvananthapuram

**Collaborators:** M/s Hykon India Ltd

**Brief Description:** C-DAC, in collaboration with Hykon India Ltd. is proposing implementation and demonstration of a renewable energy microgrid that is suitable for industrial as well as urban requirements. C-DAC possesses ample background know how for the above technology demonstration project. The domain expertise of M/s Hykon in the area of renewable energy, UPS systems and eV battery packs will be an added benefit for the successful implementation of this pioneering work.

NEW MEITY PROJECTS

# IDEAS TO ACTION

14

**Name of Project:** Bharat Smart Meter Affordable and Reliable Technologies (B-SMART) - Design, Development and Deployment of DIR-V VEGA Enabled Smart Meters for Long Term Sustainability

**CI:** Mr Jiju K, C-DAC, Thiruvananthapuram

**Brief Description:** C-DAC has developed indigenous technology for smart energy meters under the NaMPET programme funded by MeitY, and the technology components of AMI are being developed. The technology of smart meters has already been transferred to 10 Indian industries, and few of them have produced it with the required certification. Since the requirement for smart meters may run into multiple crores, the development and implementation of smart meters with various processors are important to ensure the supply of the meters. C-DAC has been continuously working on the product upgrade of smart meters. To cater to the requirements of India, more meter manufacturing should come into production. Based on the continuous interactions with the Smart Meter ToT partners of C-DAC, it is understood that for certification and production, a proper enclosure of meter should be there. to make the enclosure mould, it is very costly and not affordable for a startup or small-scale industry. So, the ministry has decided to do the enclosure design and certification activity in a project mode along with the TRL upgrade of the VEGA-based smart meter design. The enclosure design activity also has cash contributions from ToT partners. The objective of this project is to develop a validated Smart Meters platform with common enclosure and use of DIR-V VEGA in Smart Meters controllers for long-term sustainability.

**Name of Project:** Applications & Technologies for Cellular Vehicle to Everything (PILOT)

**CI:** Dr. S V Srikanth, C-DAC Hyderabad

**Co-CI:** Mr Santosh Sam Koshy, C-DAC Hyderabad

**Funding Agency:** Technology Innovation Hub on Autonomous Navigation and Data Acquisition Systems (TiHAN) at IIT Hyderabad

**Brief Description:** V2X technology aims to improve road safety, traffic efficiency, and overall transportation systems by enabling vehicles to exchange information with other vehicles, infrastructure elements, and even people. The goal is to create a more connected and aware transportation environment that enhances safety and efficiency for all road users. The need for an On-Board Unit (OBU) for motorcycles and electric scooters arises from the growing demand for enhanced connectivity, safety, and convenience in modern vehicles. While OBUs are more commonly associated with larger vehicles like cars and trucks, there are several compelling reasons why motorcycles and electric scooters could benefit from these devices as well. Overall, while motorcycles and electric scooters have unique characteristics, the advantages of enhanced connectivity, safety, and convenience provided by OBUs are highly relevant to these vehicles. As technology continues to advance, the integration of OBUs into two-wheeled transportation is likely to increase, addressing the specific needs and challenges faced by riders in this category.

1

NEW R&D PROJECTS

# IDEAS TO ACTION

(External Funding)

**Name of Project:** Design and Development of a IoT based truly Wireless Automatic Weather Stations (WAWeS) Platform for Agricultural Applications

**CI:** Mr. Santosh Sam Koshy, C-DAC Hyderabad

**Funding Agency:** ICAR-Centre for Research in Dryland Agriculture (CRIDA)

**Brief Description:** The idea is to develop IoT based weather stations that can be deployed within the crop canopy in villages, generating hyperlocal weather information at a much granular level. This is a truly wireless Automatic Weather Station (AWS) platform that caters to both the macro-climate and micro-climate data requirements for agricultural applications. It will be miniature in size, battery operated, easy to deploy, wirelessly enabled autonomous and standalone sensors, that are decentralized and can be geographically spaced and deployed, as per need. Further, the WAWeS platform enables deployments within a village setting, within the crop canopy, unlike existing AWS systems which are generally deployed in cordoned off regions, at either block or mandal level for macro climate monitoring. Moving away from the rather bulky, specialized, wired, and inflexible model of the existing AWS, the proposed WAWeS platform will focus on developing a plug-n-play framework and flexible architecture to decentralize the sensing to several wireless and individual sensor devices.

2

NEW R&D PROJECTS

# IDEAS TO ACTION

(External Funding)

**Name of Project:** Design and Development of a Solution to Enable Blockchain Functionality for BhuNaksha and Webland 2.0 portals

**CI:** Ms. Jyostna Grandhi, C-DAC Hyderabad

**Co-CI:** Mr. Mahesh U Patil, C-DAC Hyderabad

**Funding Agency:** Government of Andhra Pradesh

**Brief Description:** Land records have long been riddled with the challenges making it difficult to guarantee the accuracy and ownership of land titles. Blockchain is a decentralised database that establishes the trust among stakeholders and provides a single source truth. It provides the feature of recording the data in chronologically and tamper-proof manner, creating an immutable record. In this proposed work, BhuNaksha, which holds the spatial information about the land and Webland2, which holds the ownership details of the land are augmented with the blockchain functionality to create a single source of truth from the Blockchain ledger and benefit from timestamped, immutable, transparent, and secure records.

3

NEW R&D PROJECTS

# IDEAS TO ACTION

(External Funding)



**Name of Project:** Point of care Nano biosensors for antibiotic residue detection and development of Nano antibiotics for fish disease management

**CI:** Dr. Souvik Pal, C-DAC Kolkata

**Co-CI:** Dr. Subhankar Mukherjee, C-DAC Kolkata
Dr. Subrata Sarkar, C-DAC Kolkata

**Funding Agency:** National Agricultural Science Fund (NASF), ICAR

**Brief Description:** This project seeks to integrate state-of-the-art selective nanomaterial-based biosensors, leveraging the latest Molecular Recognition Elements (MRE), to detect priority antibiotics relevant to fisheries applications. Additionally, it aims to establish an innovative system for real-time monitoring, employing a Biochemical Sensory Array Device to detect antibiotics. The project will focus on creating a cost-effective IoT-enabled sensing system, either optical or electrochemical, complemented by a soft computing-based user-friendly Graphical User Interface (GUI) to ensure effective utilization in resource-limited conditions.

Furthermore, the collaborative expertise aims to develop nanoparticle-conjugated antibiotics to combat drug-resistant microorganisms, which pose significant threats to fish health and economic stability due to Antimicrobial Resistance (AMR).

The objectives of this project include, the development of Nano biosensors for the rapid and straightforward detection of specific antibiotic residues in fish and water, creating a functional prototype of a handheld nano-biosensing device and formulating nano antibiotics to effectively manage antibiotic-resistant bacteria in fish pathogens.

This multidisciplinary approach is anticipated to have a profound impact by reshaping the perspectives of farmers, customers, retailers, and other stakeholders involved in fisheries. Moreover, it is expected to yield positive effects on the Gross Domestic Product (GDP) and the nation's export industry.

**Name of Project:** Development of AI-ENABLED Field Portable Microscope for detection of Filariasis

**CI:** Mr. Gopinath Bej, C-DAC Kolkata

**Co-CI:** Dr. Alokesh Ghosh, C-DAC Kolkata
Dr. Amitava Akuli, C-DAC Kolkata
Mr. Abhra Pal, C-DAC Kolkata
Mr. Tamal Dey, C-DAC Kolkata

**Funding Agency:** Biotechnology Industry Research Assistance Council (BIRAC)

**Brief Description:** Filariasis, caused by parasitic worms of the Filarioidea type, remains a significant health concern in many parts of the world, particularly in tropical and subtropical regions. Early detection of microfilariae (mf) in blood smears is crucial for effective treatment and control of the disease. However, traditional microscopy methods for detecting mf often require specialized equipment and trained personnel, making diagnosis challenging in remote or resource-limited areas. To address this issue, we propose the development of "FIL-O-SCOPE," a smart, portable microscope system utilizing a lens-less configuration for the rapid and accurate detection of microfilariae in blood smears. FIL-O-SCOPE incorporates advanced artificial intelligence and machine learning algorithms to automate the detection process, enabling even individuals with minimal expertise to perform accurate diagnoses in remote locations.

**Name of Project:** Development of Indigenous Artificial Intelligence based Oral Cavity Imaging Device and Image Analysis Techniques for Preliminary Screening of Oral Cancer and Precancer Lesions

**CI:** Ms. Sonia Dosanjh, C-DAC, Mohali

**Co-CI:** Dr. Sanjay Madan, C-DAC, Mohali

**Funding Agency:** Indian Council of Medical Research (ICMR)

**Brief Description:** The overall objective of the project is to develop a portable handheld Oral cavity imaging device powered by AI based for screening of oral cancer. The device will be able to classify and identify the suspicious oral lesions and provide oral cancer diagnosis from the captured images. The use of a point-of-care device for oral cancer detection using AI has the potential to revolutionize the current standard of care and significantly improve patient outcomes.

6

NEW R&D PROJECTS

# IDEAS TO ACTION

(External Funding)

7

NEW R&D PROJECTS

# IDEAS TO ACTION

(External Funding)

**Name of Project:** Design & Development of C-V2X Universal Hardware Adapter for Traffic Signal Controllers in Autonomous Vehicle Navigation

**CI:** Dr. Prakash.R, C-DAC, Thiruvananthapuram

**Co-CI:** Mr. Hemant Jeevan Magadum, C-DAC, Thiruvananthapuram

**Funding Agency:** Technology Innovation Hub on Autonomous Navigation and Data Acquisition Systems (TiHAN) at IIT Hyderabad

**Brief Description:** The objective of this project is to enhance the hardware feature of the existing traffic signal controller to make it autonomous vehicle ready by developing a hardware adapter using Cellular V2X technology and to make the application to communicate the signal timing information to the RSU to disseminate on the digital cockpit unit of the Autonomous vehicle/ passenger cars. This improves intersection safety by informing vehicles about upcoming signal changes, allowing them to adjust their speed and behaviour accordingly to avoid last-minute stops or unsafe manoeuvres. It optimizes traffic flow by providing accurate and timely information about signal phases and timing. This can lead to smoother traffic flow and reduced congestion.

# PROGRESS PULSE:

## A PERFORMANCE DASHBOARD

# IPR PORTFOLIO

To create awareness and increase the Intellectual Property Rights (IPR) footprint across C-DAC, the Corporate IPR Cell has been established. Details of the IPR activities of C-DAC during this quarter are as below:

| | IPR portfolio of C -DAC (Year 2013 to March 2024) | | | | Quarterly IPR portfolio of C -DAC (January 2024 - March 2024) | | |
|---|---|---|---|---|---|---|---|
| | **Patents** | **Copyrights** | **Trademarks** | **Design** | **Patents** | **Copyrights** | **Trademarks** |
| Applied/Filed (Pending) | 79 | 5 | 8 | 1 | 1 | 1 | 5 |
| Granted/Registered | 91 | 181 | 22 | 0 | 6 | 2 | 0 |
| **Total** | **170** | **186** | **30** | **1** | **7** | **3** | **5** |

# MAJOR PROJECT PERFORMANCE/ STATISTICS

**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, thereby facilitating import substitution and value addition in electronics sector in the next 5 years. As per the approval accorded by Cabinet, DLI Scheme is being implemented by C-DAC.

The Design Linked Incentive (DLI) Scheme shall offer 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 over a period of 5 years.

The Scheme strengthens Startup and MSMEs for semiconductor design thereby facilitating indigenization and import substitution with value addition in electronics sector in the next 5 years.

| Application Status | |
|---|---|
| Total Applications Received | 35 (16 Startup + 19 MSME) |
| Application Evaluation completed | 21 |
| Applications under Evaluation | 14 |
| Applications Approved for DLI Funding | 11 |
| Applications approved for EDA Tool grid Support | 24 |

# MAJOR PROJECT PERFORMANCE/STATISTICS

## MOBILE SEVA (MOBILE SERVICE DELIVERY GATEWAY)/ MOBILE SEVA APPSTORE

Mobile Seva platform is an innovative initiative aimed at mainstreaming mobile governance in the country. It provides an integrated whole-of-government platform for all Government departments and agencies in the country for delivery of public services to citizens and businesses over mobile devices using SMS, IVRS, CBS, LBS, apps and AppStore. It is a centrally hosted cloud-based mobile enablement platform, which allows the departments to expeditiously start offering their services through mobile devices anywhere in India, without having to invest heavily in creating their separate mobile platforms. Over 4827 accounts of government departments and agencies are integrated with Mobile Seva platform. Over 5,959 crore transactions and 9 cr+ apps download have taken place.

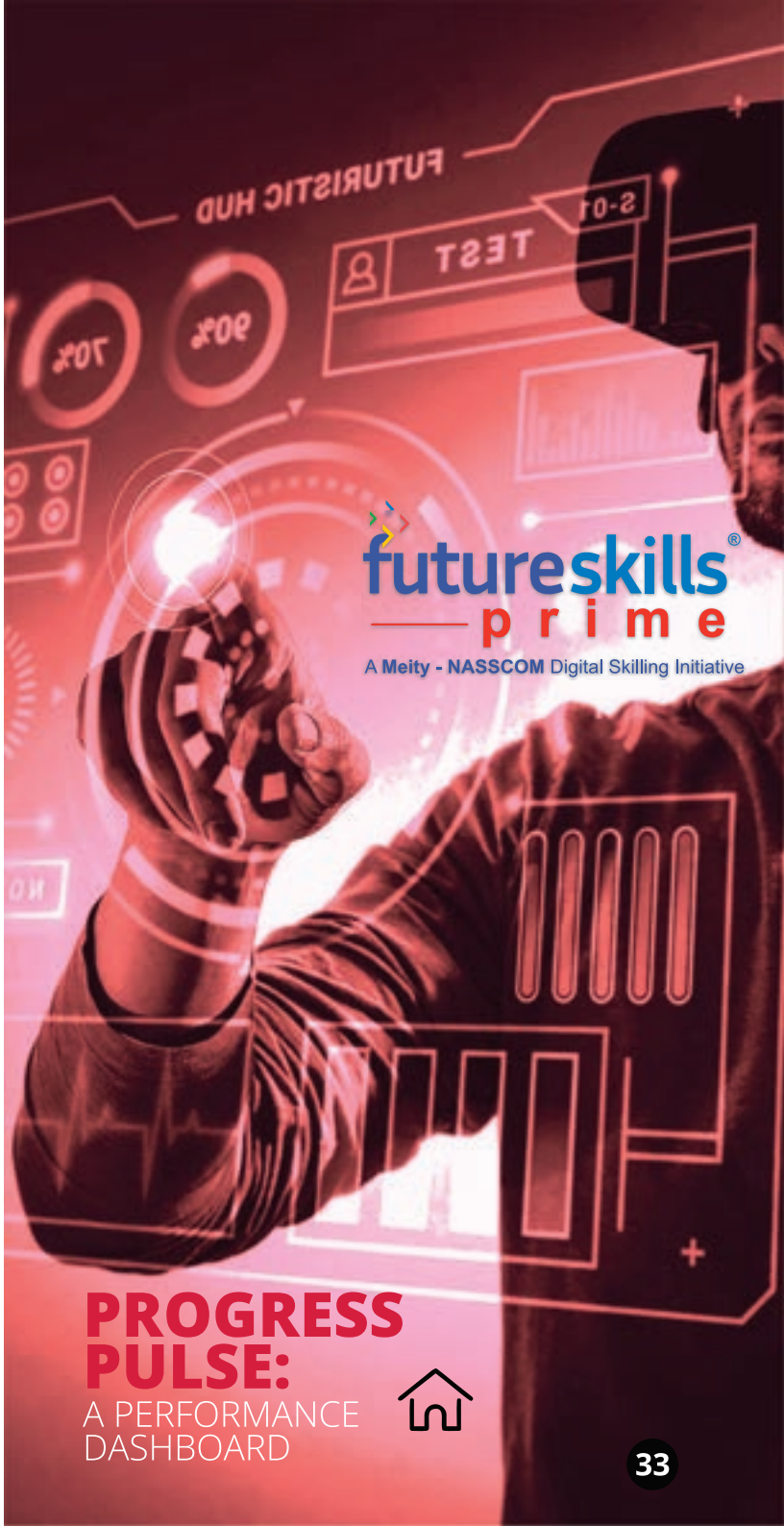
| Mobile Seva platform | | |
|---|---|---|
| | **April 2012 to March 2024** | **January 2024 to March 2024** |
| Accounts of Dept/Agencies integrated | 4755 | 72 |
| No of Push SMS Transaction | 5791 Cr | 168 Cr |
| No of apps | 1755 | 199 |

# MAJOR PROJECT PERFORMANCE/STATISTICS

## FUTURESKILLS PRIME

Future Skill PRIME - Programme for Re-Skilling/Up-Skilling of IT Manpower for Employability: MeitY and NASSCOM have jointly conceived the Programme titled, "FutureSkills PRIME, under the Champion Sector Service Scheme (CSSS). The Programme is envisaged to provide re-skilling/up-skilling opportunities to 4.12 Lakh IT Professionals of B2C beneficiaries in ten(10) emerging technologies: 3D Printing/Additive Manufacturing, Blockchain, Cyber Security, Internet of Things, Artificial Intelligence, Robotics Process Automation, Social & Mobile, Big Data Analytics, Cloud Computing and Augmented Reality/ Virtual Reality, through Resource Centres across the Nation by Hub-n-Spoke Model. 17.93 Lakh candidates have signed up on the FutureSkills PRIME portal: www.futureskillsprime.in. Around 6.81 lakh candidates have enrolled for Foundation/Deep-Skilling/ Bridge and non-aligned courses out of which, around 2.89 lakh candidates have completed the courses. 11451 Government officials from Central/State Government Offices/Departments/ PSUs trained across the Nation and 2367 Trainers trained under Training of Trainer Programme". The details of IT Professionals/Government Officials/Students trained by C-DAC Resource Centres in Government Officials Training Programme, Training of Trainer Programme and Bridge Course is as below:

| FutureSkills PRIME | | | | |
|---|---|---|---|---|
| | December 2019 to March 2024 | | January 2024 to March 2024 | |
| Sign Ups | 17.93 Lakhs | | 1.41 Lakhs | |
| | Enrolled | Certified | Enrolled | Certified |
| Government Officials Training | 6705 | 5346 | 305 | 393 |
| Training of Trainer | 1861 | 1596 | 76 | 222 |
| Bridge Course | 22976 | | 3037 | |



# MAJOR PROJECT PERFORMANCE/STATISTICS

## E-HASTAKSHAR / E-SIGN

As part of the Government's Digital India Initiative, C-DAC has developed e-Hastakshar – C-DAC's eSign service that facilitates instant signing of documents online/offline based on Aadhaar authenti-cation to government and private agencies. C-DAC utilizes service of Unique Identification Authority of India (UIDAI) for on-line authentication and Aadhaar eKYC service. e-Hastakshar service supports both One Time Password (OTP)/ToTP and Biometric (Fingerprint/IRIS/Face) based modes of authen-tication for leveraging eKYC service of UIDAI.

More than 15.01 Cr e-Signs have been offered by C-DAC till March 2024. More than 220 Government agencies are leveraging C-DAC's esign service on production level. Several key new agencies Minis-try of Agriculture and Farmer Welfare, Financial Intelligence Unit-India, Directorate of IT Maharash-tra with existing key agencies Employees' Provident Fund Organisation, National Informatics Centre, Centre for eGovernance, Karnataka are leveraging eSign on production level.

| eSigns offered by C-DAC | |
|---|---|
| **July 2016 to March 2024** | **January 2024– March 2024** |
| 15.01 Cr | 1.53 Cr |


**PROGRESS PULSE:**
A PERFORMANCE DASHBOARD

# MAJOR PROJECT PERFORMANCE/STATISTICS

## INFORMATION SECURITY EDUCATION AND AWARENESS (ISEA) PROJECT PHASE –II AND III

| Information Security Education and Awareness (ISEA) Project Phase –II and III details | | |
|---|---|---|
| **ISEA Activities** | **April 2015 to December 2023** | **January 2024 to March 2024** |
| **Academic Activities** (Can-didates have been trained/are undergoing training in various formal/ non-formal courses in the area of Information Security) | 94,300 candidates trained/ under-going training through 52 institutions.<br>In addition, 2.90 lakhs can-didates reported as trained/under-going train-ing by affiliated colleges of 5 Technical Universities un-der the project | 3rd Phase of ISEA started from Jan,24 and selection of Institu-tions are under progress |
| **Government Officials Training** (Government officials have been trained in various shortterm programmes in the area of information security through direct/e-learning/Virtual Instructor Led Training (VILT) mode. | 28,440 candidates trained so far | 3rd Phase of ISEA started from Jan,24 and selection of Institu-tions are under progress. |
| **Awareness Activities** | ISEA Phase –II details up to December 2023 as followed:<br>1,567 awarenes workshops on Information Security covering 3,53558 participants. Besides this, 1,25,489 school teachers have been trained as master trainers in 45 training programmes. In addition, around 5.75 crore estimated beneficiaries have been covered so far through indirect mode. | ISEA Phase –III details from January 2024 to March 2024<br>As part of National Awareness Campaign on Information Security Education and Awareness (ISEA) Program – Phase III a total of 25 Awareness workshops / Training were organized by covering 15,258 participants |

# MAJOR PROJECT PERFORMANCE/STATISTICS

## eSanjeevani

eSanjeevani is the National Telemedicine Service of Ministry of Health & Family Welfare (MoHFW), Government of India. Owing to its widespread and speedy adoption, eSanjeevani has evolved into the world's largest documented telemedicine implementation in the primary healthcare. eSanjeevani – National Telemedicine Service is testimony to the fact that digital health has come of age in India. eSanjeevani has revolutionised primary healthcare in India by bringing health services to the masses in rural areas and isolated communities. In eSanjeevani network nationally 1,40,885 Health and Wellness Centres (HWCs) have been registered as spokes and 19,568 hubs have been operationalized. eSanjeevani boasts over 2,11,849 doctors, specialists, and health workers as telemedicine practitioners, operating in all states and union territories of India. It serves approximately 4,25,000 patients daily, with the capacity to handle up to 1 million patients per day. eSanjeevani is operational in all States/UTs across India. However, In Delhi, eSanjeevaniAB-HWC is not available.

| eSanjeevani usage Report | | | | |
|---|---|---|---|---|
| | November 2019 to March 2024 | | January 2024 to March 2024 | |
| | Total Tele-Consultations | Registered Doctors | Total Tele-Consultations | Registered Doctors |
| **eSanjeevani** | 226,464,367 | 63,151 | 33,023,843 | 3,298 |
| eSanjeevaniAB-HWC | 215,337,638 | 53,852 | 32,801,210 | 2,582 |
| eSanjeevaniOPD | 11,126,729 | 9,299 | 2,22,633 | 716 |

# MAJOR PROJECT PERFORMANCE/STATISTICS

**e-Sushrut- C-DAC's Hospital Management Information System**

e-Sushrut- C-DAC's Hospital Management Information System is a major step towards adapting technology to improve healthcare. HMIS incorporates an integrated computerized clinical information system for improved hospital administration and patient health care. It is integrated with ABDM Mile Stones and provides an accurate, electronically stored medical record of the patient. A data warehouse of such records can be utilized for statistical requirements and for research. The real time HMIS streamlines the treatment flow of patients and simultaneously empowering workforce to perform to their peak ability, in an optimized and efficient manner.

| e-Sushrut usage Report | | |
|---|---|---|
| | No. of Patient Visited | |
| | Till March 2024 | January 2024 to March 2024 |
| e-Sushrut for AIIMS (15 No's) | 21264406 | 2164935 |
| e-Sushrut PAN Railways HMIS | 32432501 | 4087590 |
| SAIL BSL e-Sushrut HMIS | 576010 | 124070 |
| HMIS-NHM UP | 13767842 | 2886529 |
| HMIS- DGME UP | 8699114 | 1919451 |
| Punjab | 37155760 | 5921866 |
| Telangana | 19473404 | 3835474 |
| Odisha | 40194585 | 3743343 |
| NIMS HMIS Hyderabad | 3922482 | 195753 |
| HMIS Maharashtra | 12268281 | 1685055 |
| IGIMS Patna | 479160 | 238104 |


**PROGRESS PULSE:**
A PERFORMANCE DASHBOARD

# MAJOR PROJECT PERFORMANCE/STATISTICS

**e-Sushrut- C-DAC's Hospital Management Information System**

| e-Sushrut usage Report | | |
|---|---|---|
| | No. of Patient Visited | |
| | Till March 2024 | January 2024 to March 2024 |
| HMIS TN | 103061 | 103061 |
| HMIS HP | 97171 | 85391 |
| SAIL RSP e-Sushrut HMIS | 65889 | 63002 |
| Goa State | 1581638 | 242560 |
| GIMS | 539146 | 59321 |
| Arunachal Pradesh | 1271791 | 171840 |
| Sikkim | 354090 | 140117 |
| NHPC | 170997 | 27724 |


**PROGRESS PULSE:**
A PERFORMANCE DASHBOARD

# MAJOR PROJECT PERFORMANCE/STATISTICS

**Blood Bank Management System- e-Raktkosh**

e-RaktKosh is a comprehensive IT solution to connect, digitize and streamline the workflow of blood banks. 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. eRaktKosh is integrated with various state-wide blood bank solutions & has become a single data repository for management of data regarding blood availability, blood-related products, blood donation camps, donor repository etc.

| eRaktKosh | | |
|---|---|---|
| | **Year 2017 to March 2024** | **January 2024 to March 2024** |
| Total Blood Bank Registered | 4,140 | 55 |
| Total Govt Blood Bank Registered | 1,249 | 5 |
| No of Active Blood Banks | 3,020 | 3,189 |
| No of Camp Conducted | 1,11,259 | 12,371 |
| No of Donor Registered | 56,77,442 | 4,26,442 |

# MAJOR PROJECT PERFORMANCE/STATISTICS

## IPDMS 2.0, INTEGRATED PHARMACEUTICAL DATABASE MANAGEMENT SYSTEM 2.0

An integrated responsive web-based application having integrated functional flow for drugs and medical devices price monitoring and regulation has been designed and deployed as IPDMS version 2.0.

NPPA-National Pharmaceutical Pricing Authority (NPPA) was constituted vide Government of India Resolution dated 29th August, 1997 as an attached office of the Department of Pharmaceuticals (DoP), Ministry of Chemicals & Fertilizers to independently monitor and regulate the pricing of drugs (including medical devices), monitoring their prices and to ensure availability and accessibility of medicines at affordable prices.

The detailed usage of IPDMS is as follows-

| Activities done by Pharma/Medical Devices Companies & NPP | Till March 2024 | January 2024– March 2024 |
|---|---|---|
| Total Companies (Drugs & Medical Devices) Registered in the IPDMS 2.0 | 1495 | 50 |
| Number of Manufacturing Unit verified by the companies | 6705 | 252 |
| Number ofDrugs verified by companies | 47919 | 2639 |
| Medical Devices Plant Registered | 12538 | 252 |
| Medical Devices Registered | 46291 | 4483 |
| Quarterly Stock Collection | 7771 | 699 |
| State Pricing Monitoring Resource Unit (PMRU) registered. | 31 | 0 |
| Form-I (Application for Price Fixation) Submitted | 350 | 77 |
| Form-II (Submission of Revised Prices) Submitted | 9735 | 288 |
| Form-III (Quarterly Return) Submitted | 34319 | 6102 |
| Form-IV (Discontinuation of Production) Submitted | 90 | 24 |

**PROGRESS PULSE:**
A PERFORMANCE DASHBOARD

# MAJOR PROJECT PERFORMANCE/STATISTICS

## IPDMS 2.0, INTEGRATED PHARMACEUTICAL DATABASE MANAGEMENT SYSTEM 2.0

| Activities done by Pharma/Medical Devices Companies & NPP | Till March 2024 | January 2024– March 2024 |
|---|---|---|
| Form-V (Price List) Submitted | 56797 | 9133 |
| Form – VI (Medical Devices) Submitted | 38903 | 6230 |
| Complaints Registered through Web and Mobile Apps | 4870 | 601 |
| Legal Cases Registered for Overcharging | 547 | 398 |

The Ceiling and Retail Price calculations of drugs with defined overcharging workflows linked with 30 state PMRUs have been automated and implemented in IPDMS 2.0 application. Individual can verify ceiling price and register overcharging complaints through mobile apps.

# MAJOR PROJECT PERFORMANCE/STATISTICS

**MEeT [Medical Education with e-Technology]-**

MEeT [Medical Education with e-Technology]- is a web based ubiquitous platform, with web and mobile based access, presently being used for delivery and conduction of online courses and impart professional training in Health & Medical Science Education. The platform has been designed, developed and deployed, as part of the MeitY sponsored projects- Technology Mediated Delivery of Courses in Medical Science Education for NER Medical Colleges) and Facilitation of IT enabled Trainings for Generating Skilled HCW's in General Pandemic Management & Covid -19 Management.


# MAJOR PROJECT PERFORMANCE/STATISTICS

**MEeT [Medical Education with e-Technology]-**

As part of the projects, online courses & IT enabled professional Trainings are being offered through the platform to Health Care Workers [HCW's] and medical fraternity. The courses include essential clinical modules and General Pandemic & Covid-19 Pandemic Management modules, developed in association with AIIMS, Delhi. The e-courses consist of various skill based and handholding courses, covering the essentials of the course, with audio-video explanations, self-assessments and quizzes, interactivity through discussion forum, feedback etc. and expert Live sessions. Till date a total of 12000+ medical students /HCW's have enrolled and are accessing the courses from primarily 268 medical colleges including 8 NER medical colleges, through the platform. Created Virtual Teaching infrastructure in eight NER medical colleges, as part of the project.

Salient Features of the MEeT platform- Course Management Multi –format content support, Content Management, SSO Integration, Interactive features like Discussion forum, chat, Social Media Integration, Mobile app integration etc.

| | March 2020 to March 2024 | | January 2024 to March 2024 | |
|---|---|---|---|---|
| **Program Name** | No. of Institutes involved | No. of Students enrolled | No. of Institutes involved | No. of Students enrolled |
| IT enabled trainings on General Pandemic Management& Covid -19 Pandemic Management | 552 | 17062 | 268 | 6662 |
| Medical education e -courses | 504 | 15300 | 240 | 6100 |
| **Total** | **1056** | **32362** | **508** | **12,762** |

**PROGRESS PULSE:**
A PERFORMANCE DASHBOARD

# MAJOR PROJECT PERFORMANCE/STATISTICS

## SWAYAAN: CAPACITY BUILDING FOR HUMAN RESOURCE DEVELOPMENT IN UNMANNED AIRCRAFT SYSTEM

Project 'SwaYaan: Capacity Building for Human Resource Development in Unmanned Aircraft System' is led by C-DAC Hyderabad and IIITDM Kurnool as the Programme Management Unit (PMU) to develop a UAS/Drone Ecosystem across the Nation. The project is implemented in a hub-and-spoke model through 30 institutions including IISc Bengaluru, IITs, IIITs, NITs, CDAC, and NIELIT Centres. Under the project, the overall target is to train 45,000+ candidates through various Formal, Non-Formal programs and Research Program such as MTech in UAS/Drones, Minor degree/Retrofitting courses in UAS/Drones, PG Diploma Program, Short term Skilling Courses, Innovation Challenge, Bootcamps, POC, National Workshops, International Conference, Open Online Courses, IPR (Paper and Patents) creation, etc. over a period of 5 Years.

As on date, overall, 274 activities have been conducted across India as part of various Academic programs, Research & innovation activities, Trainings/Workshops, and other Knowledge sharing initiatives to train 6,275 participants thereby expediting the spirit of the Nation towards becoming a Global Drone Hub by 2030.

| | Activity: 2023-2024 | | Participants: 2023-2024 | |
|---|---|---|---|---|
| **Program Name** | **Sept 2022 – March 2024** | **January 2024 – March 2024** | **Sept 2022 – March 2024** | **January 2024 – March 2024** |
| FDP | 10 | 1 | 260 | 24 |
| Workshop | 5 | 0 | 411 | 0 |
| Bootcamp | 116 | 28 | 4294 | 916 |
| PG-Diploma | 2 | 0 | 10 | 0 |
| POC | 76 | 36 | 387 | 210 |
| M-Tech | 1 | 0 | 11 | 0 |
| Minor Degree | 3 | 0 | 66 | 0 |
| Retrofitting Electives | 45 | 24 | 789 | 155 |
| IPR-Paper | 14 | 8 | 42 | 25 |
| IPR-Patent | 2 | 0 | 5 | 0 |
| **Total** | **274** | **97** | **6275** | **1330** |


# TECH ROLLOUTS

SYSTEM/ PRODUCT/ SERVICES LAUNCH/ RELEASE

# TECH ROLLOUTS

## LAUNCH OF M-PRABANDH

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

# TECH ROLLOUTS

## LAUNCH OF PARIKSHAN

Parikshan, an automated tool for Security Analysis of mobile applications was launched by Shri. S Krishnan IAS, Secretary, MeitY, Government of India on February 2, 2024 at C-DAC Hyderabad

# TECH ROLLOUTS

## LAUNCH OF DIGITAL INDIA FUTURELABS



An announcement on two futureDESIGN semiconductor fabless companies under the Semicon India Design Linked Incentive (DLI) scheme with C-DAC as nodal implementing agency was made by Minister of State for Electronics & IT, Skill Development and Entrepreneurship, and Jal Shakti, Shri Rajeev Chandrasekhar during the launch of "Digital India FutureLABS" at IIIT Delhi on February 03, 2024.

# TECH ROLLOUTS

## LAUNCH OF THEJAS32 E-LAGORI AND ADVIK-VEGA HARDWARE DEVELOPMENT KIT


Shri. Rajeev Chandrasekhar, Honorable MoS Electronics and IT launched the THEJAS32 E-LagoRi module developed Trachealth Technologies leveraging C-DAC's DIR-V VEGA Processor at the Digital India Future Labs Summit, IIIT, New Delhi on February 03, 2024 in the august presence of Prof. Ranjan Bose, Director IIIT Delhi and Shri. Magesh E, DG, C-DAC.


Shri. Rajeev Chandrasekhar, Honorable MoS Electronics and IT launched the Advik-Vega Hardware Development Kit by CoreEL Technologies leveraging C-DAC's DIR-V VEGA Processor at the Digital India Future Labs Summit, IIIT, New Delhi on February 03, 2024 in the august presence of Prof. Ranjan Bose, Director IIIT Delhi and Shri. Magesh E, DG, C-DAC.

# TECH ROLLOUTS

## LAUNCH OF GANGA



GANGA - A Non-Reproducable Cryptographically Secure PRNG is launched on February 29, 2024, at the International Symposium on Security Engineering for Trusted Cyberspace (ISSETC) – 2024, in Rajgir, Bihar. The launch was officiated by Shri Bhuvnesh Kumar, IAS, Additional Secretary, Ministry of Electronics and Information Technology (MeitY), Government of India (GoI), in the presence of Shri Jitendra Singh Gangwar, ADG Police Headquarter, Bihar Police, Ms. Tulika Pandey, Scientist 'G' & Group Coordinator (R&D in Cyber Security and UIDAI), MeitY, GoI and Shri Aditya Kumar Sinha, Scientist 'G' & Director, C-DAC Patna & Kolkata

# TECH ROLLOUTS

## LAUNCH OF GAMIFIED LEARNING ASSESSMENT MANAGEMENT SYSTEM (GLAMS)


Gamified Learning Assessment Management System (GLAMS) launched on February 29, 2024, at the International Symposium on Security Engineering for Trusted Cyberspace (ISSETC) – 2024, in Rajgir, Bihar. The launch was officiated by Shri Bhuvnesh Kumar, IAS, Additional Secretary, Ministry of Electronics and Information Technology (MeitY), Government of India (GoI), in the presence of Shri Jitendra Singh Gangwar, ADG Police Headquarter, Bihar Police, Ms. Tulika Pandey, Scientist 'G' & Group Coordinator (R&D in Cyber Security and UIDAI), MeitY, GoI and Shri Aditya Kumar Sinha, Scientist 'G' & Director, C-DAC Patna & Kolkata.

# TECH ROLLOUTS

## INAUGURATION OF ADVANCED SYSTEM FOR SOLID-PROPELLANT BURN RATE MEASUREMENT FACILITY

Advanced System for Solid-Propellant Burn Rate Measurement Facility jointly inaugurated by Chairman, DRDO and DG, C-DAC at High Energy Materials Research Laboratory (HEMRL) of the Defence Research and Development Organisation (DRDO) in Pune 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.

# TECH ROLLOUTS

## INAUGURATION OF QUBIT STUDIO



C-DAC, Bengaluru inaugurated the QuBIT Studio - Quantum Accelerated Computing Laboratory on Tuesday, January 23, 2024. The ceremony was officiated by Shri. S. Krishnan IAS, Secretary of the Ministry of Electronics and Information Technology (MeitY), in the presence of Smt. Sunita Verma, Scientist G & GC, MeitY, and Dr. C M Chandrashekar from the Department of Inorganic and Physical Chemistry, Indian Institute of Science (IISc).

# TECH ROLLOUTS

## LAUNCH OF PARKING PAYMENTS THROUGH THE NATIONAL COMMON MOBILITY CARD (NCMC) AND STORE VALUE PASS (SVP) QR


Chennai Metro Rail Limited (CMRL) has achieved a historic feat by becoming the first metro in India to launch parking payments through the National Common Mobility Card (NCMC) and Store Value Pass (SVP) QR on February 21, 2024.

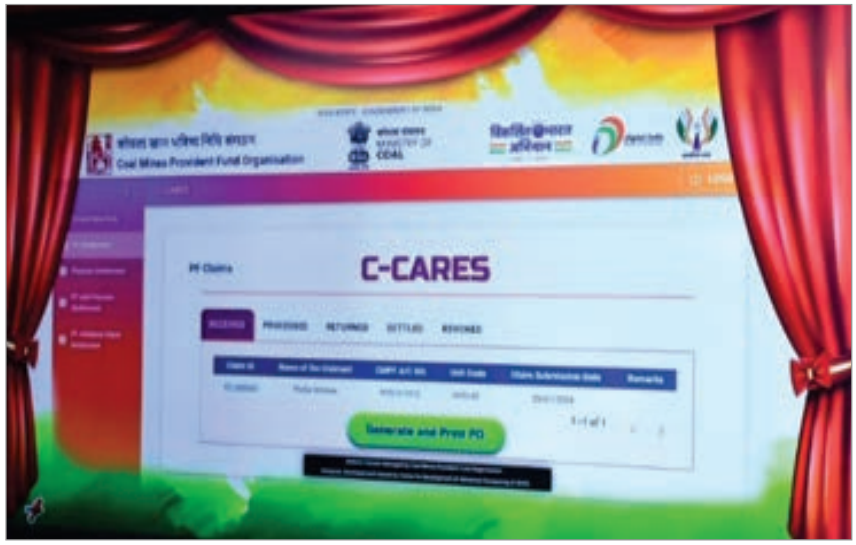
# TECH ROLLOUTS

## INAUGURATION OF SYMPOSIUM ON ACCELERATING BIOLOGY 2024


C-DAC hosted a three-day symposium ("Accelerating Biology 2024: The Exascale Leap") from February 06 - 08, 2024. The symposium was inaugurated by Padma Bhushan Dr. Vijay Bhatkar and Prof. Sunil Bhagwat, IISER, Pune, in the presence of Shri. E. Magesh, Director General, C-DAC, Col A. K. Nath (Retd.), Executive Director, C-DAC, Pune and Dr. Rajendra Joshi, Senior Director and HoD of HPC: Medical and Bioinformatics Applications, C-DAC, Pune

# TECH ROLLOUTS

## LAUNCH OF CENTRALIZED CLAIM PROCESSING & SETTLEMENT PORTAL (C-CARES)




On January 31, 2024, the Union Minister of Coal, Mines and Parliamentary Affairs, Shri Pralhad Joshi, launched the Centralized Claim Processing & Settlement Portal (C-CARES), Phase II. The portal, designed and developed by C-DAC, Bengaluru, aims to streamline the claim processing and settlement for coal miners.

# TECH ROLLOUTS

## WORKSHOP ON "ENGINEERING AND INTEGRATION CHALLENGES IN QUANTUM COMMUNICATION AND QUANTUM COMPUTING"

C-DAC Pune hosted a two-day workshop on "Engineering and Integration Challenges in Quantum Communication and Quantum Computing" on March 21-22, and an Industry networking day on March 23, 2024. The workshop was inaugurated under the esteemed presence of Smt. Sunita Verma (Group Coordinator, R&D in IT, MeitY), Shri. Magesh Ethirajan (Director General, C-DAC), Col. A.K. Nath (Retd.) (Executive Director, C-DAC Pune and Corporate Strategy) and Dr. S. D. Sudarsan (Executive Director, C-DAC Bengaluru) at The Orchid Hotel Pune on March 21, 2024.

# **INTERNATIONAL** OUTREACH

# **INTERNATIONAL** OUTREACH

Visit of Hon'ble Minister of Digital Transformation, Government of Republic of Trinidad & Tobago

Delegation from Ministry of Digital Transformation, Government of Trinidad & Tobago led by H.E. Mr. Hassel Bacchus, Hon'ble Minister of Digital Transformation, Government of Republic of Trinidad & Tobago visited C-DAC, Delhi on January 22, 2024.


Induction Ceremony

C-DAC Delhi recently launched a 2-week Certificate Course in General ICT for 15 participants from North Sumatra, Indonesia, as part of the Indian government's ITEC Scheme. The program was conducted during February 19, 2024 to March 01, 2024.

# **INTERNATIONAL** OUTREACH

LRIT Training for Friendly Foreign Countries

On January 20, 2024 the LRIT National Data Centre at MMDAC, Mumbai, hosted a comprehensive training session on the Long-Range Identification and Tracking (LRIT) system, organized by C-DAC, Mumbai, for visiting trainee officers from Bangladesh, Mauritius, Maldives, Seychelles, and Sri Lanka. The session provided in-depth insights into the capabilities and features of LRIT, enhancing awareness and fostering international cooperation in maritime domain awareness.

# BACKEND
SQUAD

## CISO DESK

All the C-DAC centers are in the various stages of implementation, the process of updating the asset register, preparation of the risk treatment, and implementing the controls are ongoing. Quarterly Information Security Assurance Coordination Committee (ISACC) meetings were held at the C-DAC centers. Compliance report and controls checklist was duly completed and reported to MeitY from CISO office. Core Information Security Group (CISG) has been reconstituted to review the existing policies and procedures. New relevant policies for hosting services are in progress.

The 3rd Information Security Assurance Steering Committee meeting took place on March 15, 2024, hosted by C-DAC Chennai, The Director General presided over the meeting as Chairman of the committee and all the stakeholders from 12 C-DAC centers were present in the meeting. Shri. Vinodh Kumar M, CISO C-DAC as convener of the meeting steered the proceedings. This meeting was of paramount significance as it revolved around the crucial subject of implementing the Information Security Management System (ISMS) within C-DAC.

It was decided during 46th Management Board meeting of C-DAC held in November 2023 that towards managing the software/hardware development purchases and their effective utilization, implementation of best practices and procedures, enhance productivity etc., information Officers need be in place across centres. Once officers are nominated by respective centres, the roles/responsibilities and operational aspects would be detailed by Corporate R&D for approval by DG.

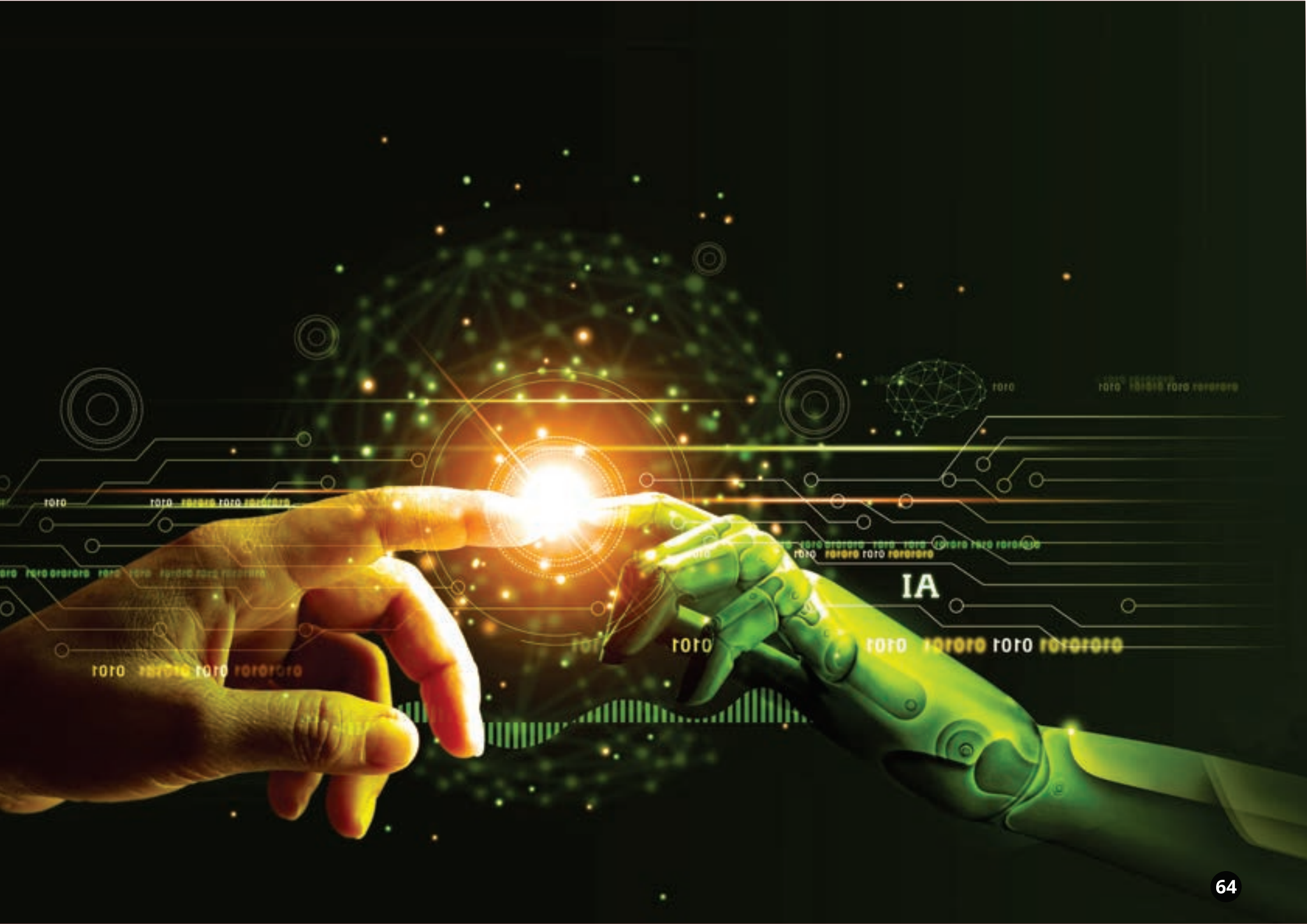
Joint meeting with CISO and CIO teams was hosted by C-DAC Thiruvananthapuram on February 01, 2024 to discuss and finalize various tasks including formation of audit team across all C-DAC centres, Rogue DHCP server's directive. Implementation of DHCP snooping, Directive for public network/ sandbox architecture etc.

Deputy CISO delivered an online awareness session for the Northern Regional Load Despatch Centre, Grid-India, as part of their Cyber Jagrookta Diwas (CJD), focusing on General Cyber Security in day-to-day life (For non-IT), Importance of Cyber Security in CII (Critical Information Infrastructure) and Cyber Incident Handling (For IT).

On February 07, 2024, a joint awareness session on Secure Financial Transactions and effective incident reporting was organized by C-DAC Patna and the Economic Offence Unit of the Bihar Police for C-DAC employees.

## CISO DESK

The inaugural C-DAC Capture the Flag (CTF) Challenge, crafted to assess cybersecurity expertise through real-world scenarios, took place virtually on February 16, 2024, as part of a cybersecurity awareness initiative of the CISO office in collaboration with the ISS team of C-DAC Kolkata. The ISS team of C-DAC Kolkata designed the Capture the Flag (CTF) open-source platform, downloadable and customisable for creating new challenges, source code is available at https://github.com/ISS-C-DACK.


IA

# INSPIRING INSIGHTS ON NEW FRONTIERS

# Innovating Telemedicine: Charting New Frontiers with AI-Driven ePrescription Audits in eSanjeevani

**Dr. Sanjay Sood,**
**Scientist - F, C-DAC Mohali**
**&**
**Sh. V.K. Sharma, Scientist – G**
**Centre Head, C-DAC Mohali**

Unsafe medication practices and medication errors are a leading cause of injury and avoidable harm in health care systems across the world. Core focus of the WHO's "Medication Without Harm" initiative is improving prescribing practices. The WHO views prescription audits as a vital tool for continuous quality improvement in healthcare, hence, they have developed prescribing indicators and guidelines that prescription audits should align with.

A prescription audit is a systematic evaluation of medication prescriptions to promote optimal patient care, rational drug use, and cost-effectiveness. It involves examining prescriptions (primarily out-patient departments) for errors, adherence to prescribing guidelines, potential drug interactions, and therapeutic appropriateness. Prescription audits are crucial for identifying areas for improvement in drug prescribing processes as well. They help ensure that patients receive the correct medications at the right dosages and for the appropriate duration. Additionally, prescription audits can lead to more efficient resource utilization within healthcare systems by minimizing unnecessary or inappropriate drug use.

Prescription auditing is equally essential within digital health / telemedicine, due to the increased potential for prescribing errors (like misdiagnosis and improper medication choices) stemming from limited physical examinations, the complexity of prescribing guidelines across various regions. Audits act as a quality control mechanism by analyzing ePrescription data, comparing it to standards and references, identifying discrepancies, and providing recommendations – ultimately safeguarding patients, ensuring responsible

eSanjeevani
National Telemedicine Service


[source: https://www.who.int/initiatives/medication-without-harm]

prescribing, and promoting the safe and effective use of remote health services like C-DAC's indigenously developed eSanjeevani – National Telemedicine Service. ePrescription audit can also ensure responsible prescribing of controlled substances, which often have stricter regulations in telemedicine.

Building upon the foundational efforts to bolster medication safety and quality of care within the expansive eSanjeevani telemedicine platform, the integration of ePrescription audits emerges as a pivotal stride forward. As eSanjeevani continues its journey as the world's largest telemedicine implementation in primary healthcare, generating nearly half a million ePrescriptions daily, the imperative for a robust ePrescription audit module becomes increasingly apparent. This prompts collaborative efforts with telemedicine practitioners and pharmacists to explore modalities and design a smart ePrescription audit solution tailored to the platform's unique needs and scale.

AI holds immense potential to revolutionize eSanjeevani's ePrescription audits, offering a multifaceted approach to augment medication safety and quality of care. Specifically, AI-powered tools could identify drug interactions, incorrect dosages, or medications mismatched with diagnoses. Importantly, for this AI needs high-quality data within the EHR, should provide explainable recommendations, and always serve as a tool to support expert clinicians rather than replace their critical judgment.

The ePrescription audit system within eSanjeevani is envisaged to harnesses the power of AI/ML to ensure the accuracy, safety, and efficacy of prescribed medications. Key aspects that are being planned to be incorporated in the module include:

Prescription Data Analysis: AI algorithms would analyze prescription data

generated during teleconsultation on eSanjeevani. This data includes information such as prescribed medications, dosages, frequencies, and patient demographics including allergies.

Drug Interaction Detection: ML models will be explored for application to detect potential drug interactions within prescriptions. By comparing prescribed medications against comprehensive drug interaction databases, the system would identify any combinations that may pose risks to patient safety or reduce treatment efficacy.

Patient-Specific Recommendations: ML models could be used to analyze patient-specific data, such as medical history, allergies, and comorbidities, to generate personalized recommendations for medication management. This will enable healthcare providers to tailor treatment plans to individual patient needs, enhancing therapeutic efficacy and reducing adverse events.

In closing, the integration of AI-powered ePrescription audits within eSanjeevani marks a significant leap forward in ensuring medication safety and enhancing the quality of care within telemedicine. By harnessing cutting-edge technology to analyze prescription data, detect potential drug interactions, and provide personalized recommendations, eSanjeevani is poised to establish new benchmarks in remote healthcare delivery. As this innovative module takes shape, it underscores eSanjeevani's unwavering commitment to leveraging technology for the advancement of healthcare outcomes, ultimately fostering greater access, efficiency, and patient satisfaction in the dynamic realm of telemedicine and digital health.

eSanjeevani
National Telemedicine Service

# Tranquil Chill with Mindful Quill

**Dr. Priyanka Jain,**
**Scientist - F, C-DAC Delhi**

**समदोषः समाग्निश्च समधातु मलःक्रियाः। प्रसन्नात्मेन्द्रियमनः स्वस्थइतिअभिधीयते॥**

**-- सुश्रुत संहिता सूत्रस्थान १५/१०**

**जिसके दोष (वात, कफ, पित्त) सम हैं, जिसकी अग्नि सम है (न धिक, न कम), धातु सम हैं, मलक्रिया ठीक है, जिसकी आत्मा, इन्द्रियाँ और मन प्रसन्न हैं, वह स्वस्थ कहा जाता है।**

Ayurveda says the person is healthy who's body, mind and soul are in normal state and all physiological actions are proper, not the person who is physically healthy but mentally and spiritually not in proper state.

**सभी बीमारियां दिमाग से शुरू होती हैं , उसे ही ठीक करने से सब ठीक हो जाता है {जे सबरी बीमारियें तुमाये दिमाग में होत हैं, वाये ठीक करो तो सबै ठीक हो जाये }**

[All the diseases are in your mind, if you fix them then everything will be fine. – always warned by Mom, but still doubt as an ideal obstinate daughter]

Mental health is emerging as a crucial topic in the bustling streets of India, where chai flows freely and colors dance in the air. That's like discovering a secret society of thoughts and feelings right in our midst! If left unchecked, it might even make a tragic exit called suicide or other harm to society. Ever heard about neurons having a party? Well, they communicate through a dance called synapse, and sometimes it's a real "electric slide." Here, stress and anxiety are our unexpected party crashers. Let's see how we can join hands for a tak-thina-thin of well-being.

The walnut-shaped wonder our brain, is the superhero in charge of emotions, decision-making, and keeping you from mistaking a tomato for a watermelon. But, just like a stubborn GPS, it can sometimes lead you down unexpected roads. Neurotransmitters like serotonin and dopamine are the brain's messenger pigeons, and when they get tangled in a web of stress, it's like sending a letter to our friend but landing in Timbuktu. Did you know that our brains are capable of producing electricity? Those squishy powerhouses, have a sense of humour too. Watch out, too much stress, and it's as if our brain's circuit breaker trips, leaving you in the dark; just like classic brain move of forgetting the car keys, right?

So, let's dive into the quirky world of Indian mental health. About every seventh person is on a roller coaster with some mental health challenge. But hey, we're not alone in this maze – it's a global phenomenon! In India, our mental health drama is spicier than a Bollywood Holi party dance sequence. A whopping 74% of us have an uninvited guest called stress. And guess what? 88% of us have a date with anxiety. But fear not, as India is waking up to the importance of mental health, and meditation is one of the paramount options here to save the day. Meditation calms the neurons, brings peace to the neurotransmitter party, and restores order to the superhero headquarters. It's like a mental spa day! We can consider our brain like a sponge. Not only for soaking up information, but for absorbing dad jokes and bad puns. Laughter releases endorphins – the brain's feel-good chemicals. So, why not tickle our brain to a daily dose of giggles?

But let's not forget the unsung hero of mental health – sound sleep. If our brain were a superhero, sleep would be woman behind the successful man. Sleep cleans up the mess from the day, sorts memories like a librarian on steroids, and prepares for the next day's adventures. It's the brain's way of hitting the reset button for a rejuvenated commencement.

With the technical advancements, we are like explorers navigating the uncharted territories of the brain, armed not with compasses but with EEG caps and brain scans. We are on a quest to decode the secret language of neurotransmitters, translating them from brain hieroglyphs into messages of hope. In the tech-savvy land of India, where smartphones are practically appendages, mental health and technology have become unexpected buddies. Right from delivering samosas to our doorstep, now a days mobile apps transform our smartphone into a therapeutic sidekick for mental health. These apps coach our brain into relaxation, turning our phone into a pocket-sized zen master. It's like having a mini-meditation retreat right in our pocket; a techo-version of Sadhu Baba's Herb pudiya from Himalaya? From mindfulness reminders to mood trackers, these apps are a digital therapist. Neuro-feedback and BCI add the "Wow" factors in it. Virtual reality (VR) sprinkles some magic dust on these interventions. In the mystical realm of VR, therapists can create immersive environments to treat phobias, like a virtual fear-fighting dojo. Trying to mimic mom's lullaby?

Overworked and exhausted our brains are trying to process this unexpected plot twist. Can we get a script rewrite, please? In the whimsical world of Quantum Neuroscience, therapists will not just analyse your dreams; they will be contemplating the superposition of Schrödinger's cat's emotions. "Are you feeling dead inside or alive with existential angst?" may ask with a wink. Quantum therapists may prescribe entangled thought exercises, ensuring that our neural connections are not just firing, but doing a synchronized rock-n-roll in a parallel dimension. Quantum-induced laughter therapy may find the neurotransmitter's fraudulence to catch on their decision for vibrating with joy or entangled in a state of perpetual chuckling. With the resemblance of

Quantum theory of uncertainty and the mysterious workings of your mind—who needs a definitive answer when you can have a probabilistic punchline?

In the India's diverse textile culture, mental health is gaining recognition as a crucial thread being woven. Our "Tech-gurus" are crafting applications tailored to the sundry cultural landscape, ensuring that mental well-being is as personalized as our favourite bowl of mom's homemade curry. We are not just a nation of spices and cricket; we are a nation that values the well-being of its minds. In this dazzling drizzle of neurons and algorithms, where the beats of innovation synchronize with the rhythms, let's celebrate the fusion of tradition and technology in the grand ballroom of mental health. After all, a happy mind is a healthy mind, and a healthy mind is our most valuable treasure. So, let's raise a chai cup to mental health – the unsung hero in the vibrant tale of India's well-being!

# "Revolutionizing Healthcare: Cutting-Edge Applications and Clinic Management Software Solutions"

**Mr. Jitendra Singh, Scientist F, C-DAC Noida**
**Mr. Ajay Gupta, Scientist F, C-DAC Noida**

## Introduction

The healthcare landscape is constantly evolving, with technological advancements becoming increasingly important in improving efficiency, raising patient care standards, and simplifying administrative tasks. A notable innovation in this field is the e-Sushrut Hospital Management Information System (HMIS) for Hospitals, eSushrut@Clinic for Single Floor Clinics, which is transforming the management and operations of healthcare facilities, and Offline Solutions for clinics with limited internet and infrastructure.

eSushrut@Clinic is a visionary and state-of-the-art HMIS that provides valuable, actionable, and customized data to a diverse range of healthcare facilities and users, including administrators, doctors, and even patients. This application is specifically designed for small clinics operating on a single floor with limited resources, offering tailored solutions to meet their unique needs.

Offline HMIS solution is designed to bridge healthcare gaps in low-connectivity environments. Clinics and healthcare facilities in areas with limited internet access or infrastructure issues frequently struggle to implement and maintain robust Health Management Information Systems (HMIS). To address these challenges, an offline HMIS solution was created, specifically for environments with limited connectivity. The Offline HMIS solution functions as a stand-alone system, independent of continuous internet access. This enables clinics in remote or low-connectivity areas to manage patient data more efficiently without relying on a consistent internet connection.

e-Sushrut GS

**The Notable key features and innovation in HMIS**

e-Sushrut and eSushrut@Clinic are the crucial component of modern healthcare facilities, offering a range of notable key features and innovations that enhance patient care, streamline operations, and improve overall efficiency. Some of these key features and innovations include:

- Electronic Health Records (EHR): enables the creation, storage, and management of electronic health records, giving healthcare providers instant access to patient data such as medical history, diagnoses, medications, and treatment plans. Currently, the application stores over 20 million EHRs in five states, including one PSU-run application and 800 clinics in state of Punjab, with more being added on a continuous basis.
- Appointment Scheduling: Advanced scheduling modules enable healthcare facilities to manage patient appointments more efficiently, resulting in shorter wait times, better resource utilization, and higher patient satisfaction.
- New Lightweight HMIS Solution: recently introduced application solution includes adaptive field capture and improved performance for OPD Doctor Desks, as well as AAC/HWC with ABDM features. This system has been implemented effectively in Health & Wellness Centre (HWC), allowing users to seamlessly switch between desktops and mobile devices while ensuring a user-friendly experience for all targeted users.
- ABDM Scan and Share: a redesigned user interface with options for ABDM creation/verification, redirection, record linkage, scanning, and sharing across five states, including one PSU-run application and 800 clinics in state of Punjab.

- Interoperability: The platforms prioritise interoperability, which allows for the seamless exchange of patient data between various healthcare systems and providers. This improves care coordination, reduces test duplication, and leads to better patient outcomes.
- New QMS with ABDM Features: A Queue Management System (QMS) with ABDM capabilities, piloted for pharmacy and later expanded to other queues. Replicated in all instances and currently used in major health facilities. Recognized by NHA, the solution has been requested for release in a plug-n-play format for Personal Health Records (PHRs).
- Geo-capturing: geo-capturing for user authentication and location access for doctors/health professionals throughout state of Punjab, covering 800 Health Facilities. User-bound and profile updates occur upon logging into the Punjab. This feature enables authorities to monitor defaulters and take necessary action against them.
- Tiny-URL Feature: Implemented a Tiny-URL feature to provide secure and convenient access to OPD-Lab reports for patients. They are more shareable on social media platforms and save space in environments with limited character availability.
- Billing Management: Automating billing processes, the application reduces paperwork and errors while improving transparency in financial transactions. This ensures that healthcare facilities maintain accurate and up-to-date financial records.
- Data Security and Compliance: Prioritizing data security and compliance with healthcare regulations, the application employs robust encryption and authentication measures to safeguard patient information, ensuring confidentiality and privacy.

**Benefits of Healthcare Applications:**

- Enhanced Patient Care: like e-Sushrut and eSushrut@Clinic provide healthcare professionals with quick access to patient data, enabling them to make informed decisions and ultimately improve the quality of patient care.
- Operational Efficiency: streamline administrative processes, reducing manual work and increasing operational efficiency. This allows healthcare facilities to allocate more time and resources to delivering high-quality care to patients.
- Cost Savings: By optimizing resources, reducing paperwork, and minimizing errors, healthcare applications like e-Sushrut and eSushrut@Cliniccontribute to long-term cost savings for healthcare facilities.
- Enhanced Patient Engagement: empower patients by providing them with access to their health information, treatment plans, and appointment schedules. This leads to increased patient engagement, adherence to treatment plans, and improved overall health outcomes.
- Improved Efficiency and Accuracy: automate administrative tasks, such as appointment scheduling and billing, reducing paperwork and errors. This enables healthcare professionals to focus more on patient care, leading to improved efficiency and accuracy in healthcare delivery.
- Remote Monitoring and Accessibility: Healthcare applications enable remote patient monitoring and service provision, improving accessibility to healthcare services, especially for individuals in remote areas or with limited mobility.

- Cost-Efficiency: contribute to cost savings by optimizing processes, reducing the need for physical infrastructure, and improving resource utilization.

**Conclusion:**

As technology advances, healthcare applications such as the revolutionary e-Sushrut and eSushrut@Clinic will play an increasingly important role in shaping the industry's future. Embracing these innovations fosters a healthcare landscape that is not only more efficient but also more patient-centred, eventually leading to improved health outcomes and a better overall healthcare experience.

# Healthcare -The Transformation

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Healthcare has progressed immensely with the advancements and inclusion of emerging technologies like A.I, Cloud Computing, 3D printing, Robotics, AR/VR technologies and more recently Quantum Computing.

From the time, where the healthcare was mostly human centric, with human specific interventions and care, it has come a long way. It is now mostly technology-based interventions and care, with enhanced customer care and support. This has become possible with the advancements in the technology and like other walks of life, the technology has also impacted the health sector. The slow but steady adoption of technology has actually given the healthcare sector the opportunity to upsurge other said industries. With the consumer of healthcare realizing the high quality of care that is possible through combining actual tangible care with technology, the health care is going to outstrip other industries in the adoption and application of technology.

The healthcare sector is in the midst of a transformation. Health Informatics, and continuing medical education [CME] being one of the newer additions for the medical professionals to acquire the skills. In a recent eHealth magazine report, the Health Minister declared that digitisation is significantly boosting the healthcare and medical education industries in India while also offering much-needed data protection and claimed that technology and Artificial Intelligence are greatly assisting the medical education sector.

The incorporation of digital CME, integrated with the physical education, especially during and post the pandemic, has enabled to help improve patient engagement and enhanced professionalism and decision making. It has become as effective as physical training in equipping HCPs with high-quality, evidence-based treatment knowledge.

Amidst this health transformative landscape, technological advancements are playing a crucial role in reshaping the healthcare industry, particularly with the surge in newer technological innovations and applications, dedicated to addressing the unique needs of different segments of the healthcare. These applications are harnessing cutting-edge technologies such as Robotics, Internet of Things(IOT) , artificial intelligence (AI) and machine learning (ML), to develop innovative solutions that enhance the quality of life and promote independence among the patients, particularly the elderly. Evidence based Mental Health care, Digital technology and Artificial Intelligence (AI) are essential enablers for a patient-centric health system. Artificial Intelligence (AI) Technology offers the immense possibilities to transform. India's Healthcare systems address its major concerns, primarily: Cost, Quality and Accessibility. Behavioral intervention technologies (BITs) such as AI-Therapy's Overcome Social Anxiety may offer a potential solution to resolve barriers to access and expand mental health care.

Advanced computing techniques, can analyze large datasets of patient information to understand users' sentiments, detect signs of distress and provide timely care. Natural Language Processing (NLP). Virtual Reality (VR) and Augmented Reality (AR) offer immersive environments, simulate real-life scenarios, providing controlled and safe environments for therapy sessions, secure video conferencing, real-time data sharing, and remote monitoring of patients facilitates telepsychiatry and teletherapy services. Developing mobile applications and wearable devices to monitor individuals' mental health metrics, such as heart rate variability, sleep patterns, and activity levels can provide continuous data for diagnosis and prognosis. Creation of personalized treatment plans of therapy to tailor interventions. Overall, competencies in advanced computing empower mental health professionals to leverage technology effectively, enhance the quality of care, reach broader populations.

From Patient -doctor virtual consultations[tele-consultation], AI-powered Virtual medical assistants, AR/VR enabled medical content and simulative medical case scenarios, telemedicine, remote monitoring to robotic surgeries and AI based decision support systems, to cognitive mental health care services, the list of possible technology applications for healthcare is ever expanding.

The time has come when one will witness robots that will be able to work, in conjunction and alongside humans by 2030. The risk of human made mistakes or injuries, will be diminished, while working with robots and with a combination of enhanced ML (Machine Learning) / AI (Artificial Intelligence) and new soft materials that won't pose any injury risk. These Technologies such as Robots/AI/ML would be seen as enhancers to patient-physician dynamics instead of substitution.


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