

Report on third 5-Day Online Faculty Development Program (FDP) on Exploring Emerging Research Trends in Computing Technologies: AI, ML, and IOT (E2RTCT-2K26)

The third 5-Day Online Faculty Development Program (FDP) on “**Exploring Emerging Research Trends in Computing Technologies: AI, ML, and IOT**” (E2RTCT-2K26) was organized by the Department of Computer Science and Engineering which was scheduled from **19th – 23rd January 2026**. The program was organized in collaboration with **Industrial University of HO CHI MINH CITY, Vietnam**. The FDP is technically sponsored by **IETE, Kolkata Chapter**.

Following the rich tradition of our Institute, the inauguration commenced with Ganesh Vandana and lamp lighting by the dignitaries, namely Prof. (Dr.) Abhijit Lahiri, Principal, MCKV Institute of Engineering, Prof. (Dr.) Satadal Saha, Dean – Academics, Prof. (Dr.) Arun kumar Jalan, Dean – Student affairs, Prof. (Dr.) Prasenjit Chatterjee, Dean – Research and Consultancy, Mr. Avijit Bose, HOD-CSE, Prof. (Dr.) S. S. Thakur, Program Coordinator, Dr. Soma Bandyopadhyay and Mr. Sumit Majumdar, Co- coordinator of this event, Mr. Puspen Lahiri and Mr. Soumya Paul, Joint Conveners of the Online Faculty Development Program.



Inauguration Program of E2RTCT - 2K26 at CSE Department Library



More Snapshots of the Inauguration Program



More Snapshots of the Inauguration Program

Due to urgent engagements our Hon. Chairman Sir, Shri. Kishan Kumar Kejriwal, Trustee Member Shri. Abhay Kejriwal, and Prof. (Dr.) Sudipta Chaki, Dean – Administration could not attend the Inauguration program.

The Online Inauguration program started at 11.15 am, which was coordinated smoothly by Mr. Puspen Lahiri, Joint Convener of the FDP. He welcomed all the dignitaries, participants and discussed in detail about the FDP. We had the honor to have Prof.(Dr.) Bui Thang Hung from the Industrial University of Ho-Chi Minh City, Vietnam as the Chief Guest of the program. The Inauguration speech was delivered by Prof. (Dr.) S. S. Thakur, Coordinator of this 5-day FDP. He welcomes all the participants and express his confidence about learning new technologies in these coming 5 days of this FDP. Our respected Principal Sir, Prof. (Dr.) Abhijit Lahiri appreciated the Department of Computer Science and Engineering for taking the initiative to organize this international collaborative FDP. He highlighted the quality of the insightful sessions and emphasized the importance of meaningful interactions between the speakers and participants. He also expressed his confidence that this program would lead to fruitful outcomes, with the participants emerging as true beneficiaries of this initiative.

Prof. (Dr.) Partha Sarathi Chakraborty CEO of MCKV Group, expressed his gratitude to the Industrial University of Ho Chi Minh City (IUH), Vietnam, as a valued collaborator, and specifically appreciated the term “Industrial” in its name, reflecting its focus on practical and applied learning. He also acknowledged the benefits of the MoU signed between MCKV Institute of Engineering and IUH, Vietnam, highlighting its potential advantages. Finally, he conveyed his best wishes for the grand success of this FDP. The session ended with Vote of Thanks by Mr. Avijit Bose, HOD - CSE and he assure that the department will conduct similar programs in near future.

It's a 5 – day program, and on the first day 2 sessions were conducted, and each session is of 2 hours duration, and in the remaining days of the program one session were conducted. In total 06 speakers agreed to deliver their lectures, out of which 2 speakers are from IUH, Vietnam, 1 Speaker from NIT, Durgapur, 2 speakers are from Jadavpur University, and 1 Speaker is from MAKAUT West Bengal. A total of 49 participants attended the FDP, which includes 19 external participants from other institutions all over the country, and 30 internal participants from organizing institute.

Day 01: First Session

Speaker: Prof. (Dr.) Debashis De, MAKAUT, West Bengal

Topic: Social Internet of Things (SIoT) for Sustainable Convergence

Session Coordinator: Mr. Subir Bhadra

The first lecture of Day 1 was delivered by Prof. Debashis De, Professor, Department of Computer Science and Engineering, MAKAUT. His enlightening session focused on the transformative role of Artificial Intelligence (AI), Internet of Things (IoT), and Cloud Computing in promoting Social Internet of Things (SIOT) for Sustainable Convergence, particularly in addressing societal challenges through technological innovation.



Some Snapshots of 1st session Day - 1

Prof. De started his lecture with the concept of SIoT, where smart objects establish social relationships similar to human networks. It highlighted how SIoT enhances scalability, trust, and autonomous decision-making among devices. The speaker explained sustainable convergence through efficient resource sharing and energy optimization. Real-world applications in smart cities, healthcare, and intelligent transportation were discussed. Emphasis was given to interoperability among heterogeneous IoT systems.

The role of social networking principles in improving service discovery was explained. Security, privacy, and trust management issues in SIoT were addressed. The session covered data analytics and AI integration for sustainability. Case studies demonstrated improved system performance using SIoT models. Environmental sustainability through reduced energy consumption was emphasized. Challenges such as standardization and ethical concerns were discussed. The session encouraged interdisciplinary research in SIoT. Participants gained insights into future research directions. Overall, the lecture was informative and aligned with sustainable technological development. The session concluded with a brief yet engaging Q&A round, where participants interacted with Prof. De to clarify concepts and discuss practical applications. Prof. De thought-provoking responses enriched the participants' understanding of how AI, IoT, and Social Internet of Things (SIOT) for Sustainable Convergence can be leveraged for societal benefit.

Day 01: Second Session

Speaker: Prof. (Dr.) Bui Thanh Hung, IUH Vietnam

Topic: 3Br-MGD: A Three-Branch Deep Encoder and Meta-Learning Framework for Toxicity Prediction

Session Coordinator: Mr. Soumya Paul

Prof. (Dr.) Bui Thanh Hung delivered an insightful session on advanced deep learning techniques for toxicity prediction, focusing on the proposed 3Br-MGD framework, which integrates multi-branch deep encoders with meta-learning. The session began with a brief overview of the challenges in computational toxicity prediction, such as data scarcity, task heterogeneity, and poor generalization across toxicity endpoints. Prof. Hung explained the motivation behind using a three-branch deep encoder architecture, where each branch is designed to learn complementary molecular representations from different feature modalities, including molecular graphs, fingerprints, and physicochemical descriptors. The importance of multi-view representation learning in capturing complex structure-toxicity relationships was clearly highlighted.

The speaker then elaborated on the meta-learning strategy adopted in 3Br-MGD, emphasizing how task-level learning enables rapid adaptation to unseen toxicity endpoints under few-shot learning scenarios. The concepts of meta-training, inner-loop and outer-loop optimization, and task-level generalization were discussed in a simplified yet technically rigorous manner.

1- Introduction

Computational chemistry/biology
DBP
Pesticide toxicity

Mutagenicity: Lactar
Reproductive toxicity: Fish
Acute oral toxicity: Frog
Androgen EDCs: Endocrine Disruptors
MERG Marker: Prox-MERG
Skin sensitization: Prox-Skin
Estrogen EDCs: Endocrine Disruptors

<https://scistore.cambridgesoft.com/chembiobdraw/>

Activate Windows
Go to Settings to activate Windows.

2- Related work

New Dataset
Chemical data
Biological data
Pharmacology data

Extracting data

Optimized model convergence

Tuned Model

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Snapshots of 2nd session Day - 1

Experimental results demonstrating the superior performance of 3Br-MGD over single-branch and conventional deep learning models were presented. The framework's effectiveness in handling class imbalance and cross-dataset generalization was also discussed. At the end of the session, Prof. Hung addressed several questions from participants related to the scalability of the framework, practical deployment in real-world toxicology studies, and future research directions involving explainability and integration with experimental assays.

Overall, the session provided valuable insights into state-of-the-art research combining deep learning and meta-learning for toxicity prediction and was highly beneficial for researchers and scholars working in machine learning and computational toxicology.

Day 02: First Session

Speaker: Prof. (Dr.) Suvamoy Chander, MAKAUT, NIT Durgapur

Topic: Support Vector Machine (SVM)

Session Coordinator: Dr. Deep Suman Deb

Dr. Suvamoy Changder has given brief outline on different classification methodologies, like Nearest Neighbour, Decision Tree, Neural Network, Logistics Regression. What are the pros and cons of those methodologies are also highlighted. Thereafter, Speaker has started with the concept of Support Vector Machine (SVM) and why it is better than others are also explained.

Support Vector Machines

- The classical regression and Bayesian classification are based on very strict assumption that the p.d.f are known
- But in real world it is not available always. The only available information is the training dataset.
- Linear Models are very powerful for regression whenever the stated assumptions are true.
- For non-linear learning, SVM is one of the best

$$g(x) = w_1x_1 + w_2x_2 + w_0$$

The plot shows a 2D coordinate system with axes x_1 and x_2 . A hyperplane is drawn, separating two classes of data points (circles and squares). The hyperplane is labeled with the equation $g(x) = w_1x_1 + w_2x_2 + w_0$. The plot also shows the support vectors and the margin.

Snapshots of 1st session Day - 2

The history of SVM from the invention to the deployment are discussed. He has mentioned about what is Support Vector and which points are going to be selected as Support Vectors, How Support vectors help in finding Hyper Plane and Marginal Planes to get maximum accuracy with minimal chances of having misclassified data. In-depth mathematical derivations are being discussed by the speaker to find out the optimal hyperplane.

• In our case,
 • The Lagrangian is
 • Min $L = \frac{1}{2} ||w||^2 - \sum_{i=1}^m \lambda^{(i)} [y^{(i)} (w^T x^{(i)} + w_0) - 1]$ w. r. t w and w_0
 • $= \frac{1}{2} ||w||^2 - \sum_{i=1}^m \lambda^{(i)} [y^{(i)} (w^T x^{(i)} + w_0) - 1] + \sum_{i=1}^m \lambda^{(i)}$ (1)
 • $dL/dw = w - \sum_{i=1}^m \lambda^{(i)} y^{(i)} x^{(i)} = 0$; $w = \sum_{i=1}^m \lambda^{(i)} y^{(i)} x^{(i)}$ (2)
 • $dL/dw_0 = -\sum_{i=1}^m \lambda^{(i)} y^{(i)} = 0$ (3)
 • Substituting these in eq 1:
 • Min $L = \frac{1}{2} \sum_{i=1}^m \sum_{j=1}^m \lambda^{(i)} \lambda^{(j)} y^{(i)} y^{(j)} (x^{(i)} \cdot x^{(j)}) - \sum_{i=1}^m \sum_{j=1}^m \lambda^{(i)} \lambda^{(j)} y^{(i)} y^{(j)} (x^{(i)} \cdot x^{(j)}) - \sum_{i=1}^m \lambda^{(i)} y^{(i)} w_0 + \sum_{i=1}^m \lambda^{(i)}$
 $= \sum_{i=1}^m \lambda^{(i)} - \frac{1}{2} \sum_{i=1}^m \sum_{j=1}^m \lambda^{(i)} \lambda^{(j)} y^{(i)} y^{(j)} (x^{(i)} \cdot x^{(j)})$ (Handwritten: $\lambda^{(i)} y^{(i)} = \lambda^{(j)} y^{(j)}$)
 • So, all we have the dot product of $x^{(i)}$ and $x^{(j)}$
 • From $\sum_{i=1}^m \lambda^{(i)} y^{(i)} = 0$, we can get $\lambda^{(i)}$
 • Now knowing the $\lambda^{(i)}$ we can find the weights w for the margin separating hyper plane: $w = \sum_{i=1}^m \lambda^{(i)} y^{(i)} x^{(i)}$
 • After training and finding the w , given an unknown point u measured on features $x^{(i)}$ we can classify it by looking at the sign of
 $f(x) = w \cdot u + w_0 = \sum_{i=1}^m \lambda^{(i)} y^{(i)} (x^{(i)} \cdot u) + w_0$

After the session, Hon. speaker has answered the questions from the participants on Hard SVM, Soft SVM, are they necessary, effectiveness of SVM in Image Classification etc.

Day 03: First Session

Speaker: Prof. (Dr.) Sarbani Roy, Jadavpur University, Kolkata

Topic: AI for Climate Change

Session Coordinator: Ms. Moumita Goswami

Prof. Sarbani Roy has started her presentation by focusing on AI for Climate Change.

The Zoom interface shows a meeting with participants: Prof. S.S. Thakur, MCKV INSTITUTE OF ENGINEERING & TECHNOLOGY, Sarbani Roy, Druhina Dey, and MANALI SARKAR. The presentation slide is titled "AI for Climate Change" and is part of the "FDP on Exploring Emerging Research Trends in Computing Technologies: AI, ML and IoT". The speaker is Sarbani Roy, Professor, Department of Computer Science & Engineering, Jadavpur University. The slide also includes her email: sarbani.roy@jadavpuruniversity.in. The system tray at the bottom shows the date as 21-01-2026 and time as 11:03.

Advantage

- **Better Accuracy** — synthesizing multiple perspectives reduces ambiguity and increases robustness.
- **Completeness** — regions poorly seen in one view might be clear in another.
- **Noise Reduction** — combining views can suppress noise and enhance signal.
- **View-Invariant Understanding** — models can learn features consistent across views.

After the session, Hon. speaker has answered the questions from the participants how AI for Climate Change may be integrated with ML for social good. Short discussion also takes place about the research projects the Hon. Speaker is working on and its impact on society.

Day 04: First Session

Speaker: Prof. (Dr.) Nandini Mukherjee, Jadavpur University, Kolkata

Topic: Air Pollution: A Global Concern

Session Coordinator: Dr. Sasmita S. Choudhury

Professor Nandini Mukherjee is a distinguished academician and researcher in the field of Computer Science from Jadavpur University was the speaker of the day.

The screenshot shows a Zoom meeting interface. At the top, there are icons for participants: Prof. S.S. Thakur, Nandini Mukherjee, and MCKV. The main slide is titled "Air pollution: a global concern" and contains the following bullet points:

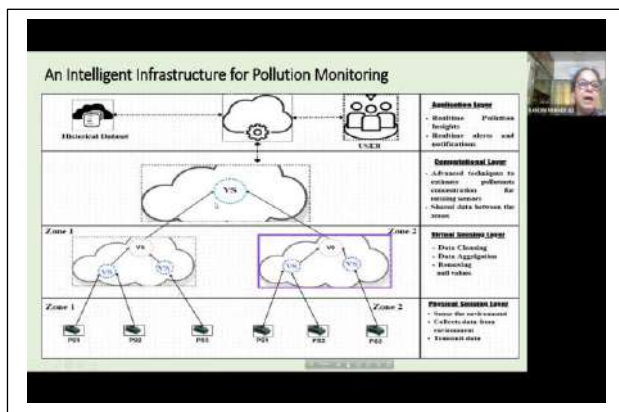
- WHO published a report in 2022 on worldwide air quality
 - (Based on information from 2010 to 2019)
- Observed that $PM_{2.5}$ concentration is rising globally
- Causing negative effects on human health, including premature death, skin rashes, lung infections
- Among the top 20 cities with highest air pollution, 18 cities are in India

Below the text, there is a map of India showing annual mean $PM_{2.5}$ concentrations in 2009 ($\mu g/m^3$). The map is color-coded according to the following legend:

Concentration Range ($\mu g/m^3$)	Color
16.0 to 30.0	Light Green
30.1 to 42.0	Yellow
42.1 to 55.0	Orange
55.1 to 71.0	Red
71.1 to 102.0	Dark Red
No data	White

At the bottom of the slide, a reference is provided: "Ref: Gokulan Ravindiran, Gasim Hayder, Karthick Kanagarathinam, Avinash Alagumalai, Christian Sonne, 'Air quality prediction by machine learning models: A predictive study on the Indian coastal city of Visakhapatnam, Chemosphere', Volume 338, 2023,".

The Hon. Speaker speaks in detail explaining how Air Pollution has become a Global concern. World Health Organization (WHO) has published a report in 2022 on world wide air quality. (Based on information from 2010 to 2019). It has been observed that PM2.5 concentration is rising globally. It is causing negative effects on human health including premature death, skin rashes and lung diseases. As per the report it has been observed that amongst the top 20 cities, with highest air pollution, 18 cities are in India, which is very alarming.



Virtual Sensors

- From applications' point of view, differences between multiple physical sensors remain transparent
- Users or applications do not know the real locations of the physical sensors
- Users or applications can use and control virtual sensors with standard functions, like 'read' or 'write'
- Dynamically grouped virtual sensors are provisioned automatically in response to the requests from users or applications
- Users or applications can destroy their virtual sensors quickly when they are not required

Snapshots of 1st session Day - 4

She has enlightened us with the different factors influencing environment pollution, data collection process and calibration of the instruments measuring the different parameters as well as research perspective. The Speaker also discussed in detail about an Intelligent Infrastructure for Pollution monitoring, and how Virtual Sensors can be used, from the application point of view.

After the session, Hon. speaker has answered the questions from the participants, how Air Pollution effect the Climate Change, recommending urgent need to integrate different sensors with ML for the benefit of society. Discussion also takes place about the research projects the Speaker is working on, the funding agencies etc. Additionally, there is an urgent requirement to increase the number of Pollution measurement centers in Kolkata and the entire country. The Pollution control board and the Government agencies, needs to be taken care of this situation. The session was interesting and very informative.

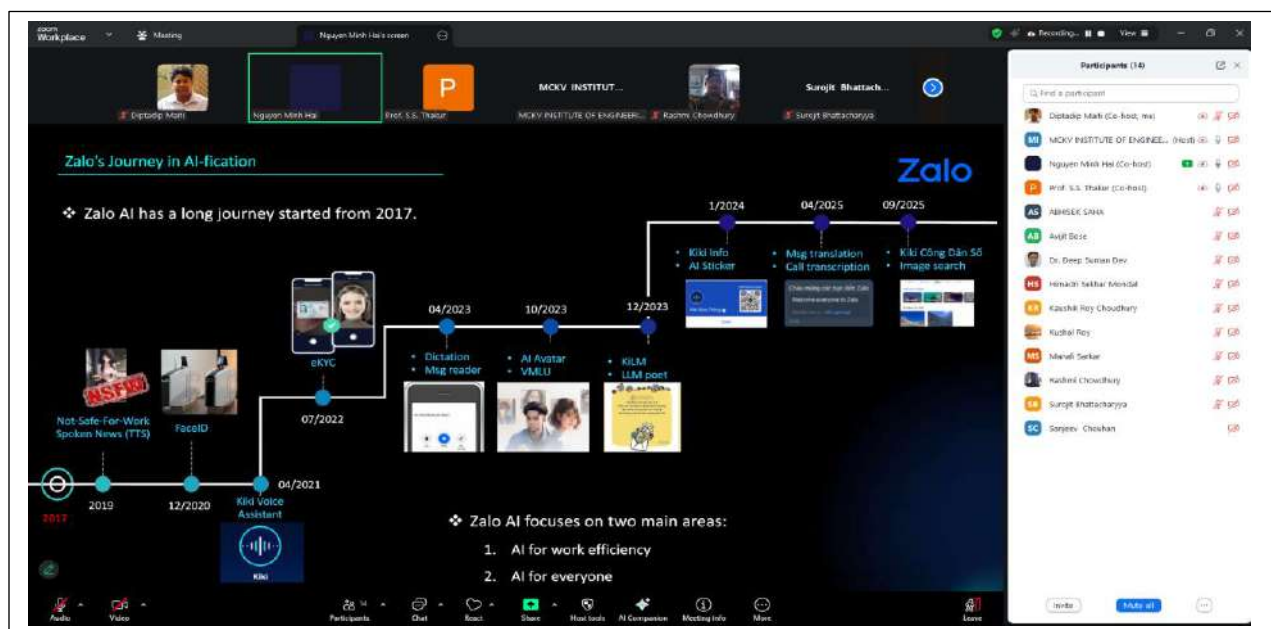
Day 05: First Session

Speaker: Prof. (Dr.) Nguyen Minh Hai , IUH, Vietnam

Topic: AI Adoption in Vietnam: Insights and Case Studies from Zalo.

Session Coordinator: Dr. Diptadip Maity

Hon. Speaker Prof. (Dr.) Nguyen Minh Hai, started his session with the topic namely AI Adoption in Vietnam: Insights and Case Studies from Zalo. He elaborates on the Evolution of AI Strategy, since 2017, the focus has shifted from solving isolated problems to image detection to achieving AI at scale. This involves two main pillars: "AI for efficiency" (optimizing internal processes) and "AI for everyone" (integrating AI into daily life scenarios). In addition to this, Model Selection Patterns allows developers often follow a two-step pattern: starting with third-party APIs (like OpenAI or Google) for rapid prototyping and then transitioning to in-house models to ensure long-term autonomy, data privacy, and cost control. Combating Hallucinations, in order to address the tendency of models to "invent" information, practitioners use relevance evaluation and additional context to adjust the model's output. Human oversight remains essential to catch and correct these hallucinations in practice.



Snapshots of 1st session Day - 5

The "95-98% Accuracy" Ceiling, is acknowledged that AI accuracy rarely reaches 100%, typically peaking between 95% and 98%. Consequently, systems should be designed as **hybrids**, where "human-in-the-loop" (HITL) processes handle complex edge cases that the AI cannot resolve. Hon. Speaker also discusses about Vietnamese Language Optimization, models often struggle with producing natural Vietnamese due to limited training data.

This is addressed by using synthetic data with slight variations and human intervention to ensure consistency and quality. He also focusses on Engineering for Massive Scale, Deploying AI for millions or billions of users requires deep engineering focus on inference optimization. Techniques such as parallelism, decoding optimization, and attention caching are critical to managing the computational load. Cost and Token Management, to manage the high costs of large-scale deployment, developers must be careful with input and output token usage. Strategies include optimizing the system to analyze and plan more efficiently to avoid unnecessary token consumption.

CHALLENGE 1: MODEL SELECTION & QUALITY CONTROL

Our AI/LLM product development process:

- Type 1: Use **existing APIs** for prototype, **optimize** models then **deploy** the products.

Flowchart for Type 1: Product Requirements → Use high-quality pre-existing API/model → Build Product → Optimize → Deploy.

- Type 2: Use **existing APIs** for prototype, build and **deploy** the product in short term, then **optimize for long-term**.

Flowchart for Type 2: Product Requirements → Use high-quality pre-existing API/model → Build Product → Deploy → Optimize → Deploy.

Participants (15)

Participant	Status
Diptadip Adak (Co-Host, MC)	Active
MCKV INSTITUTE OF ENGINEERING...	Active
Nguyen Minh Ha (Co-Host)	Active
Prof. S.S. Thakur (Co-Host)	Active
ABHINAV SARKAR	Active
Arijit Bose	Active
Chandan Roy MCKV	Active
Dr. Deep Senanayake	Active
Himadri Saha Mondal	Active
Kaushik Roy Choudhary	Active
Kunal Roy	Active
Mukul Sarkar	Active
Rishabh Choudhary	Active
Soujit Bhattacharya	Active
Vinodkumar Thakur	Active

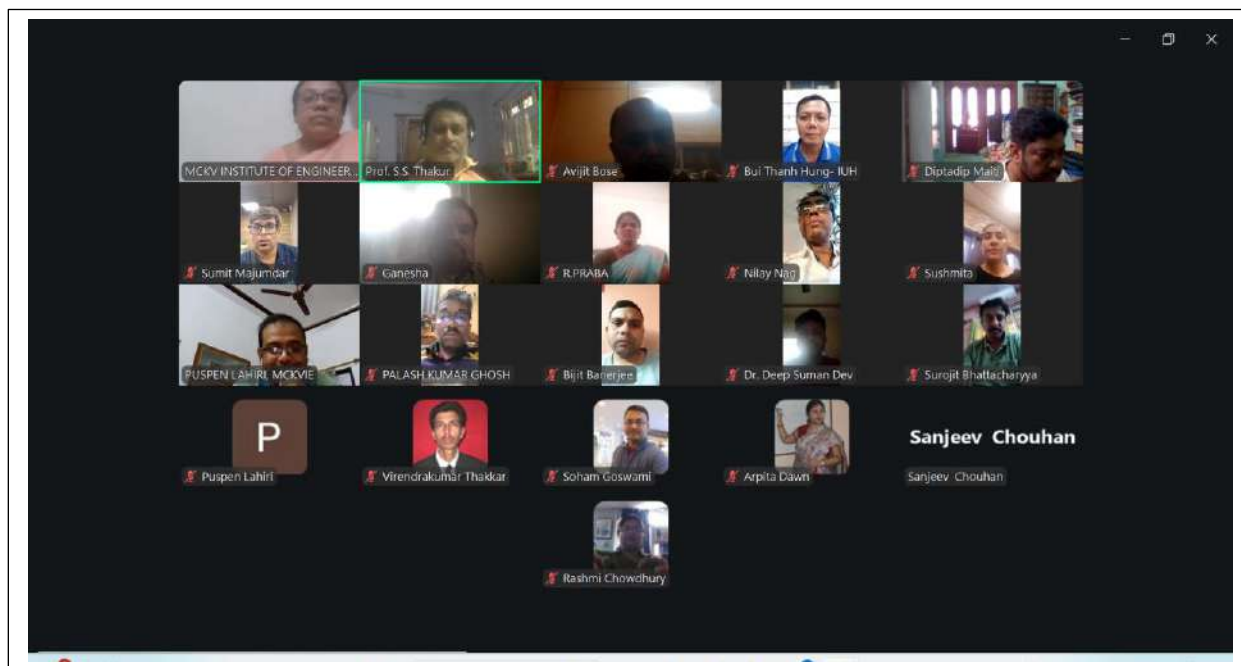
Snapshots of 1st session Day - 5

Simplifying the User Experience by recognizing that most users are not experts in "prompt engineering," the system design should include a backend layer that automatically selects prompt templates. This allows users to interact naturally while the system ensures the AI receives a high-quality prompt. Robust Safety Layers, relying on the AI model alone for safety is insufficient. A dedicated protection layer is necessary to check for harmful requests and prevent the system from returning inappropriate or sensitive information. Critical Role of Data Labelling, along High-quality data is viewed as the most important factor for model success. This involves utilizing dedicated teams for labelling training and testing datasets, which is a significant but necessary financial investment to increase domain knowledge and accuracy.

The session ended with Q & A session, where the Speaker replied to all the queries raised by the participants in an effective manner.

Valedictory Session:

The virtual valedictory session, coordinated by Mr. Puspen Lahiri, Convener E2RTCT-2K26, started at 4.00 pm on 23rd January 2026. The session marked the conclusion of a highly successful event that witnessed enthusiastic participation and insightful contributions from attendees, speakers, and organizers.



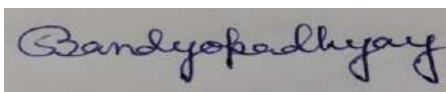
Snapshot of the Valedictory Session, Day - 5

The session began with a warm welcome by the Head of Department, CSE, Mr. Avijit Bose, who expressed heartfelt gratitude to all the participants, resource persons, and organizing committee members for their active involvement throughout the event. Mr. Bose also encouraged participants to continue embracing emerging technologies and to apply the knowledge gained in their research and teaching endeavors. He also highlighted the FDP's role in fostering innovation and the pursuit of cutting-edge research in AI, ML, and IoT.

Participants were invited to share their feedback and experiences and some participants appreciated the organization, relevance of topics, and the overall conduct of the event. The link for online assessment was given to the participants and information regarding the distribution of certificates was provided.

The session concluded with a Vote of Thanks proposed by Dr. Soma Bandyopadhyay, Co-Coordinator of E2RTCT-2K26. She thanked Chairman Sir, MCKV group, Trustee Member, and CEO of MCKV group for their continuous support for executing the FDP in coordination with IUH, Vietnam and technical sponsor IETE Kolkata Center. She also thanks Principal Sir, Dean Academics, Dean Research, Dean - Administration and Dean of Students Affairs and the Head of the Departments, for their active support. She also discussed in details the topics covered by the eminent speakers in all these 5 days. She also extended heartfelt thanks to all the participants for their active engagement throughout the five-day FDP.

Prof. (Dr.) S.S. Thakur, Program Coordinator acknowledged the invaluable contributions of the esteemed speakers and resource persons who shared their expertise. He also thanked the organizing committee members for their active involvement and continuous cooperation for making this event a grand success. He also thanked everyone involved and formally declared the valedictory session and the FDP as closed.



(Dr. Soma Bandyopadhyay)
Co-coordinator, FDP



(Mr. Sumit Majumdar)
Co-coordinator, FDP



(Prof. S. S. Thakur)
Coordinator- FDP



(Mr. Avijit Bose)
HOD – CSE