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IFAC Sponsored

Three-days National Workshop

on

Wonders of Control Systems Engineering via Drone Flying and Electric Vehicles

Date: 16-18 December 2024

The workshop is sponsored by **IFAC** in association with **ACDOS** and **SoET**, **BBSR**, **CUTM**, **Odisha**, highlighting the importance of collaboration and innovation in the field of control systems engineering. This partnership aims to inspire young minds to explore the endless possibilities within this domain. **IFAC** is a global organization promoting advancements in automatic control and systems engineering. Founded in 1957, it fosters collaboration through conferences, workshops, and research, bridging academia and industry to address global challenges. **ACDOS**, **IFAC's** National Member Organization **(NMO)**, supports innovation in control systems and dynamic optimization. It connects Indian researchers with the global community, empowering them to tackle real-world challenges with advanced technologies.

School of Engineering and Technology, BBSR, CUTM, Odisha

International Federation of Automatic Control (IFAC)

Automatic Control & Dynamic Optimization Society (ACDOS)

A REPORT

On

IFAC Sponsored

Three-days National Workshop

On

Wonders of Control Systems Engineering Via Drone Flying and Electric Vehicles 2024

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Overview

School of Engineering & Technology, BBSR, CUTM, Odisha in association with **Automatic Control & Dynamic Optimization Society (ACDOS)** organized a Three-days national workshop **from 16th to 18th December 2024**, The event was sponsored by the **International Federation of Automatic Control (IFAC) with a funding of €6,000 (Six Thousand Euros).**

The theme was **"Wonders of Control Engineering via Drone Flying and Electric Vehicles."** The program was specifically designed for senior high school (pre-undergraduate) students to introduce them to the fundamentals of control systems and their diverse applications. Approximately one hundred thirty students from various other schools like **(Bhadrak Engineering School And Technology, Asurali, Bhadrak, Zenith Institute of Science and Technology, Government Polytechnic Bargarh, Kendriya vidyalaya Khurda road, Cohen International school)** etc. and **Schools of CUTM from various campuses** actively participated in this workshop.

The workshop aimed to blend theory with practical applications, providing participants with a comprehensive understanding of **control engineering**. Leveraging platforms like **Drone** and **Electric vehicle operations**, the sessions featured interactive discussions and hands-on activities.

The entire workshop was meticulously coordinated by **Dr. Sudhansu Kumar Samal**, **Prof. (Dr.) Ramesh Ch. Mohanty**, and **Prof. (Dr.) Sujata Chakravarty** under the guidance of **Prof. (Dr.) Radhakant Padhi**. Their collective efforts ensured the smooth execution of the program, which was highly appreciated by participants and experts alike. The interactive sessions and practical demonstrations left a lasting impact, enriching the knowledge and enthusiasm of all attendees.

Resource Persons:

Prof. (Dr.) Radhakant Padhi
IISc, Bangalore

Prof. (Dr.) Dayaram Sonawane
COEP Tech University, Pune

Prof. (Dr.) Sachit Rao
IIIT, Bangalore

Dr. Sudhansu Kumar Samal
Centurion University, Odisha

Dr. Salahudden
PEC, Chandigarh

Trainers:

Mr. P S V S Sai Kumar,
IISc Bangalore
Mr. Yokesh K,
IISc Bangalore
Dr. Kamal Kumar Barik,
CUTM, Odisha
Dr. Mukundjee Pandey,
CUTM, Odisha
Mr. Sameer Mohapatra,
CUTM, Odisha
Dr. Chinmaya Nanda,
CUTM, Odisha

Agenda:

IFAC Sponsored Three-day Tutorial Workshop on Wonders of Control Systems Engineering via Drone Flying and Electric Vehicles		
Day-1 (Monday)		
09:30 AM - 09:35 AM **09:35 AM - 09:40 AM** **09:40 AM - 09:45 AM** **09:45 AM - 09:50 AM** **09:50 AM - 10:00 AM**	**Inaugural Address** 1. Shri Hare Krishna Rath, (IEEE, BBSR) 2. Mr. Bodhisatwa Sanhapriya, (IG Drones, BBSR) 3. Prof. PSRS Shastry, DRDO, Bangalore 4. Prof. D. N. Rao, (VP, CUTM) 5. Prof. Radhakant Padhi, IISc Bangalore 6. Prof. Niranjan Sahu, IIT Guwahati	
10:00 AM - 11:30 AM	Motivation for Control Systems: Forcing bad systems to behave good	Speaker: Prof. Radhakant Padhi, IISc Bangalore
11:30 AM - 12:00 PM	**Tea Break**	
12:00 PM - 01:00 PM	Basics of Electric Vehicles	Speaker: Prof. Sudhansu Kumar Samal, CUTM Odisha
01:00 PM - 02:00 PM	**Lunch Break**	
02:00 PM - 03:00 PM	Control Systems in E-Vehicles	Speaker: Prof. Dayaram Sonawane, COEP Tech University, Pune
03:00 PM – 03:30 PM	Understanding Different Components of a Drone (hardware and software level)	Mr. P S V S Sai Kumar and Mr. Yokesh K, IISc Bangalore
03:30 PM - 04:30 PM	Hands-on Activities: Assembly and setup of drones (in groups)	Mr. P S V S Sai Kumar, Mr. Yokesh K and CUTM Drone Pilot and Simulation Team
04:30 PM - 05:00 PM	**Tea Break**	
05:00 PM - 06:00 PM	1. Introduction to Software In The Loop (SITL) Simulations 2. Demonstration of an Example Problem: Waypoint flying	Mr. P S V S Sai Kumar and Mr. Yokesh K, IISc Bangalore
Day-2 (Tuesday)		
09:30 AM - 11:00 AM	Control Systems for Autonomous Vehicles: Drones and Mobile Robots	Speaker: Prof. Sachit Rao, IIIT Bangalore
11:00 AM - 11:30 AM	E-Vehicle Assembly Requirements	Speaker: Prof. Sudhansu Kumar Samal, CUTM Odisha
11:30 AM - 12:00 PM	**Tea Break**	
12:00 PM - 01:00 PM	Hands-on Activities: Drone Simulations	CUTM Drone Pilot and Simulation Team
01:00 PM - 02:00 PM	**Lunch Break**	
02:00 PM - 04:30 PM	Drone Flying Experience in separate groups: 1. Manual Flying of Drones by Experienced Drone Pilots 2. Autonomous Flying of Drones	CUTM Drone Pilot and Simulation Team. Mr. P S V S Sai Kumar, Mr.Yokesh K
04:30 PM - 04:45 PM	**Tea Break**	
04:45 PM - 05:15 PM	Essentials of Drone Pilot Program	CUTM Drone Pilot and Simulation Team
05:15 PM - 06:00 PM	**QUIZ (with prizes)**	
06:00 PM - 07:00 PM	**Cultural Programme**	
Day-3 (Wednesday)		
09:30 AM - 10:30 AM	E-Vehicle Assembly Experience	Prof. Sudhansu Kumar Samal and Team, CUTM Odisha
10:30 AM - 11:00 AM	Drone Control Design Philosophy	Speaker: Prof. Salahudden, Asst. Professor, PEC Chandigarh
11:00 AM - 11:30 AM	**Tea Break**	
11:30 PM - 12:00 PM	E-Vehicle Driving Experience	Prof. Sudhansu Kumar Samal and Team, CUTM Odisha
	Valedictory Function	
12:00 PM – 12:10 PM **12:10 PM – 12:20 PM** **12:20 PM – 12:30 PM** **12:30 PM – 12:40 PM**	1. Dr. Aiswarya Biswal, Chairperson, Bharat Petroleum, Chief Guest 2. Prof. Damodar. Acharya, Guest of Honour 3. Prof. Jayesh Barve, President, ACDOS (online) 4. Prof. Sujata Chakravarty, CUTM, Odisha	
01:00 PM - 02:00 PM	**Lunch and Departure**	

Inaugural Address:

Day-1
Dt-16.12.2024
Time-09:30 AM

Deliberation on the Session:

The event was inaugurated by distinguished guests, including **Shri Hare Krishna Rath** (IEEE, Bhubaneswar), **Mr. Asish Kumar Jena** (CFO), **Prof. PSRS Shastry** (DRDO, Bangalore), **Prof. D. N. Rao** (Vice President, CUTM), **Prof. (Dr.) Radhakant Padhi** (IISc Bangalore), **Prof. Niranjan Sahu** (IIT Guwahati), and **Prof. (Dr.) Sujata Chakravarty** (Dean, SoET, Bhubaneswar campus). The inaugural session was a momentous event that set the tone for the workshop. Distinguished guests brought a wealth of knowledge and experience, enriching the session with their insightful addresses.

Shri Hare Krishna Rath emphasized the importance of interdisciplinary learning and how IEEE is fostering innovation in the field of engineering. **Mr. Asish Kumar Jena** provided a comprehensive overview of CUTM's commitment to bridging the gap between academia and industry through cutting-edge research and projects. **Prof. PSRS Shastry** shared his insights into the evolving landscape of control engineering, drawing from his extensive experience at DRDO, Bangalore. **Prof. D. N. Rao** virtually highlighted the university's vision of integrating technological advancements with practical applications to empower students for future challenges. **Prof. (Dr.) Radhakant Padhi** captivated the audience with his discussion on the role of control systems in aerospace and automotive engineering, showcasing real-world examples. **Prof. Niranjan Sahu** offered a glimpse into emerging research areas and encouraged students to explore innovative solutions in engineering domains. **Prof. (Dr.) Sujata Chakravarty** the Dean of SoET, concluded the session by outlining the objectives of the workshop and expressing gratitude to all attendees and collaborators.

Session 1:

Day-1
Dt-16.12.2024
Time-10:00 AM

Motivation for Control Systems (Forcing bad systems to behave good):

Deliberation on the Session:

Prof. (Dr.) Radhakant Padhi from IISc Bangalore delivered an enlightening session titled "Motivation for Control Systems: Forcing Bad Systems to Behave Good." Through this thought-provoking lecture, **Prof. (Dr.) Radhakant** emphasized the critical role of control systems in stabilizing and optimizing systems that inherently exhibit undesirable or unstable behavior. Using real-world analogies and practical examples, he demonstrated how control mechanisms can transform suboptimal systems into efficient, reliable ones. The session inspired participants to think creatively about problem-solving in engineering, highlighting the transformative potential of **control systems in** diverse fields such as **aerospace, automotive, and robotics**.

Glimpses of the Session:

Session 2:

Day-1
Dt-16.12.2024
Time-12:00 PM

Basics of Electric Vehicles:

Deliberation on the Session:

Dr. Sudhansu Kumar Samal from CUTM Odisha conducted an engaging session on "Basics of Electric Vehicles," providing participants with an insightful introduction to the principles and components of electric vehicle technology. He discussed the fundamental concepts of battery management systems, powertrains, and the role of regenerative braking in enhancing efficiency. **Dr. Sudhansu** also highlighted the importance of transitioning to electric vehicles for a sustainable future, linking technical knowledge with environmental benefits. His session was both **educational** and **inspiring**, offering participants a clear understanding of the emerging trends and opportunities in the electric vehicle industry.

Glimpses of the Session:

Session 3:

Control Systems in E-Vehicles:

Day-1
Dt-16.12.2024
Time-02:15 PM

Deliberation on the Session:

Prof. (Dr.) Dayaram Sonawane from COEP Tech University, Pune, delivered a compelling session on "Control Systems in E-Vehicles." His presentation delved into the intricate role of control systems in enhancing the efficiency, reliability, and safety of electric vehicles. **Prof. (Dr.) Dayaram** provided detailed insights into the integration of sensors, actuators, and feedback mechanisms that govern the dynamic performance of electric vehicles. He also highlighted case studies and real-world applications, emphasizing the critical need for robust control algorithms in addressing challenges like energy optimization and system stability. The session was **highly informative**, offering participants a comprehensive understanding of the **synergy** between **control engineering** and **electric vehicle technology**.

Glimpses of the Session:

Session 4 & 5:

Day-1
Dt-16.12.2024
Time-03:45 PM

Understanding Different Components & Assembly and setup of Drones:

Deliberation on the Session:

Mr. P S V S Sai Kumar and Mr. Yokesh K from IISc Bangalore, along with the **CUTM Drone Pilot and Simulation Team**, conducted an interactive session on drone technology, beginning with an overview of hardware components like motors, sensors, and flight controllers, and software systems for navigation, stabilization, and communication. Participants gained insights into the interplay between hardware and software in ensuring efficient drone operation. This was followed by a hands-on activity where participants, in groups, assembled and configured drones, calibrating sensors and programming essential systems. The session effectively combined **theoretical knowledge** with **practical application**, fostering collaboration, problem-solving skills, and enthusiasm for advancements in unmanned aerial systems.

Glimpses of the Session:

Session 1:

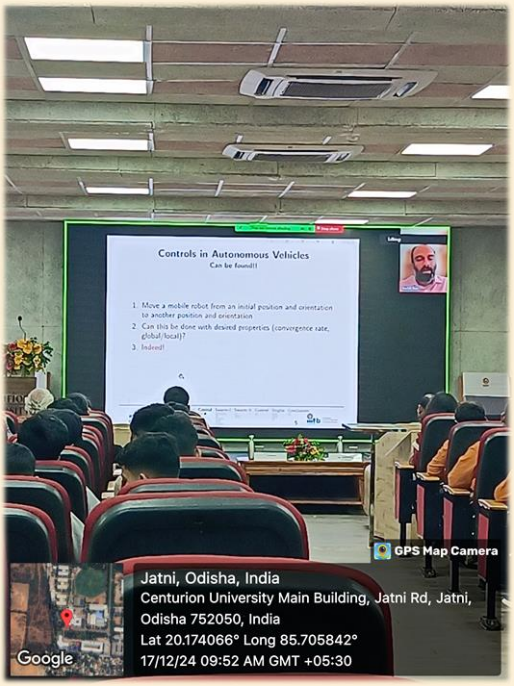
Day-2
Dt-17.12.2024
Time-09:30 AM

Control Systems for Autonomous Vehicles (Drones and Mobile Robots):

Deliberation on the Session:

Prof. (Dr). Sachit Rao from IIIT Bangalore delivered an insightful virtual session on "Control Systems for Autonomous Vehicles: Drones and Mobile Robots." His presentation explored the advanced applications of control systems in the domain of autonomous vehicles, focusing on drones and mobile robots. **Prof. (Dr.) Sachit** delved into the design and implementation of control algorithms that enable autonomous navigation, obstacle avoidance, and adaptive decision-making. He highlighted the integration of sensors, actuators, and machine learning techniques in achieving precision and efficiency in autonomous systems. Through case studies and real-world applications, **Prof. (Dr.) Sachit** inspired participants to consider the vast potential of control engineering in shaping the future of intelligent transportation and robotics. The session was both **enlightening** and **motivating**, fostering a deeper appreciation for the complexities of autonomous vehicle technology.

Glimpses of the Session:



Session 2:

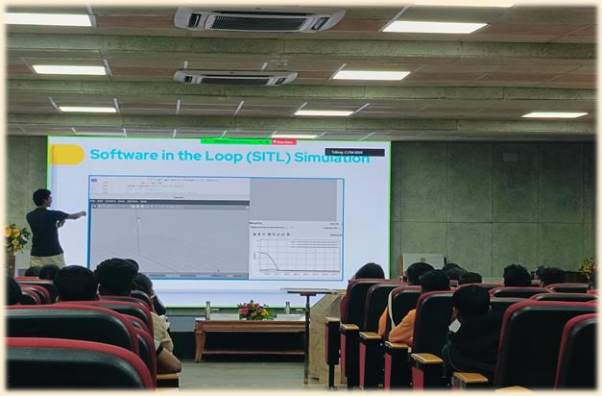
Day-2
Dt-17.12.2024
Time-10:45 AM

Introduction to Software In The Loop (SITL) Simulations & Demonstration of an Example Problem(Waypoint flying):

Deliberation on the Session:

Mr. P S V S Sai Kumar and Mr. Yokesh K from IISc Bangalore conducted a comprehensive session on "Introduction to Software In The Loop (SITL) Simulations & Demonstration of an Example Problem: Waypoint Flying." This session provided participants with a practical understanding of **SITL simulations**, an essential tool for testing and validating control algorithms in a virtual environment before deployment on physical systems. The speakers demonstrated an example problem involving waypoint flying, showcasing how SITL simulations enable precise planning and execution of drone navigation tasks. Their hands-on approach and real-world insights made the session **highly engaging**, equipping participants with **critical skills** in modern simulation techniques and autonomous control systems.

Glimpses of the Session:



Session 3:

Day-2
Dt-17.12.2024
Time-12:00 PM

Hands-on Activities (Drone Simulations):

Deliberation on the Session:

The **CUTM Drone Pilot and Simulation Team** conducted a hands-on session on "Drone Simulations," providing participants with an interactive platform to understand and engage with simulation technologies used in drone operations. Participants explored virtual environments to practice flight maneuvers, mission planning, and obstacle avoidance using simulation tools. This session allowed attendees to gain **practical exposure** to drone control systems and enhanced their problem-solving skills by **simulating real-world scenarios**. The session was instrumental in equipping participants with the foundational skills necessary for advanced drone applications, making it a highly engaging and **impactful experience**.

Glimpses of the Session:

Session 4:

Day-2
Dt-17.12.2024
Time-02:00 PM

Drone Flying Experience (Manual Flying of Drones & Autonomous Flying of Drones):

Deliberation on the Session:

The **CUTM Drone Pilot and Simulation Team**, along with **Mr. Sameer Mohapatra,** CUTM, Odisha **and Dr. Chinmaya Nanda,** CUTM, Odisha, conducted an exhilarating session on "Drone Flying Experience: Manual Flying of Drones & Autonomous Flying of Drones" Participants were provided with an opportunity to experience both manual and autonomous drone flying, **gaining hands-on expertise** in **real-world drone operations**. The session included demonstrations by experienced drone pilots, who guided participants through the techniques of manual drone control, as well as autonomous flying modes, where pre-programmed flight paths were executed flawlessly. This dual approach provided participants with a comprehensive understanding of drone **flight dynamics**, **control techniques**, and the practical **challenges of aerial operations**. The session offered a memorable learning experience for all attendees.

Glimpses of the Session:

Session 5:

QUIZ & Cultural Programme:

Day-2
Dt-17.12.2024
Time-04:00 PM

Deliberation on the Session:

In the evening of the workshop featured a "**Quiz & Cultural Programme**" starting at 4:00 PM onwards. The quiz session tested participants' knowledge and understanding of the concepts covered throughout the workshop, fostering a spirit of healthy competition and reinforcing **key takeaways**. Following this, the **cultural program** became the **highlight of the evening**, offering participants an opportunity to unwind and celebrate the shared journey of learning. The event featured a range of performances, including music, dance. showcasing the diverse talents of the participants. The cultural program created a **lively and festive atmosphere**, fostering camaraderie and leaving everyone with **cherished** memories of the workshop.

Glimpses of the Session:

Session 1:

E-Vehicle Assembly & Driving Experience:

Day-3
Dt-18.12.2024
Time-09:30 AM

Deliberation on the Session:

Dr. Sudhansu Kumar Samal and his **team from CUTM, Odisha** conducted a dynamic session on "E-Vehicle Assembly & Driving Experience." Participants were introduced to the foundational aspects of electric vehicle assembly, focusing on integrating key components such as battery systems, motors, controllers, and chassis. The session also included a hands-on segment, where participants actively engaged in assembling various parts of an electric vehicle under expert guidance. Following the assembly, attendees were given the unique opportunity to **experience driving the e-vehicles**. This activity not only enhanced their understanding of e-vehicle mechanics but also inspired enthusiasm for sustainable and innovative transportation technologies. The session was lauded for its practical **relevance** and **interactive approach**, leaving participants with valuable skills and unforgettable memories.

Glimpses of the Session:

Session 2:

Drone Control Design Philosophy:

Day-3
Dt-18.12.2024
Time-10:30 AM

Deliberation on the Session:

Dr. Salahudden, Assistant Professor at PEC Chandigarh, delivered a Virtual session on "Drone Control Design Philosophy." This session delved into the fundamental principles and advanced concepts underlying the design of control systems for drones. **Dr. Salahudden** emphasized the importance of stability, precision, and adaptability in drone control systems, addressing challenges such as environmental disturbances and payload variations. By integrating theoretical concepts with practical insights, he explained how robust control strategies ensure optimal performance in dynamic conditions. His session provided participants with a comprehensive understanding of **drone control design**, inspiring them to explore innovative solutions in this rapidly evolving field.

Glimpses of the Session:

Valedictory Function:

Day-3
Dt-18.12.2024
Time-12:00 PM

Deliberation on the Session:

The valedictory session of the three-days national workshop on "Wonders of Control Engineering via Drone Flying and Electric Vehicles" was a momentous occasion, marking the successful culmination of an **enlightening program**. The session began with a warm welcome to the esteemed guests, trainers and participants, setting the tone for an inspiring and reflective closing ceremony.

The **Chief Guest**, **Dr. Aiswarya Biswal**(Independent Director, Bharat Petroleum), delivered an inspiring speech connecting India's historical contributions to science and technology with modern advancements showcased during the workshop. Her address motivated participants to embrace innovation while drawing from the nation's legacy. **Prof. Damodar Acharya, The Guest of Honour**, emphasized blending practical skills with theoretical knowledge and encouraged students to remain curious and proactive. His words left a lasting impression on the audience. **Dr. Jayesh Barve** (President of **ACDOS**), virtually commended the organizers for curating a unique workshop that combined technology with hands-on learning. He highlighted the importance of interdisciplinary collaboration in nurturing future innovators. **Prof. (Dr.) Radhakant Padhi** (IISc Bangalore) praised the workshop's comprehensive approach, which integrated theoretical insights with practical applications in drones and electric vehicles. He urged participants to continue exploring the field with enthusiasm. **Prof. PSRS Shastry** (DRDO Bangalore) highlighted the transformative potential of such workshops in fostering innovation and academia-industry collaboration. He encouraged participants to apply their knowledge to future advancements. **Mr. P S V S Sai Kumar** (IISc Bangalore) appreciated the hands-on sessions for bridging the gap between theory and practice. He congratulated participants for their enthusiasm and urged them to utilize their new skills in innovative endeavors.

Valedictory Function:

Day-3
Dt-18.12.2024
Time-12:00 PM

Deliberation on the Session:

The valedictory session also featured the **Prize distribution** for the **quiz competition** held during the workshop. The winners were celebrated for their outstanding performance, and the moment added a sense of accomplishment and joy to the event. **Participants** were invited to **share** their **feedback about the workshop**. Students expressed their gratitude for the opportunity to gain in-depth knowledge and practical experience in control engineering, drone technology, and electric vehicles. Their **heartfelt words** highlighted the workshop's impact, **inspiring** organizers and peers alike.

Prize Distribution:



Participants Feedback:




The session concluded with a **Vote of thanks** delivered by **Prof. (Dr.) Sujata Chakravarty** Dean, SoET, BBSR. She extended her gratitude to the **Chief Guest, Guest of Honour**, and all the **dignitaries** for their invaluable contributions. **Special thanks** were conveyed to **the event organizers**, **faculty members**, and **participants** for making the workshop a **grand success**. **Prof.(Dr.) Sujata 's** heartfelt acknowledgment added a fitting and gracious end to the valedictory ceremony. Following her address, **Prof. Radhakant Padhi** expressed his **appreciation** for **Prof. (Dr.) Sujata's** efforts in organizing such a well-structured and **impactful workshop**.

Special Thanks:

Prof. (Dr.) Radhakant Padhi
Dr. Jayesh Barve
Prof. (Dr.) Sujata Chakravarty
Prof. (Dr.) Ramesh Ch. Mohanty
Dr. Sudhansu Kumar Samal
Dr. Swarna Prabha Jena
Dr. Kamal Kumar Barik
Dr. Mukundjee Pandey
Dr. Smitanjali Rout
Dr. Deepak Kumar Sahu
Dr. Sunil Kumar Mohapatra
Dr. Debashree Debadatta Behera

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Prof (Dr.) Sangram Keshari Swain
Dr. Rajendra Kumar Khadanga
Dr. Saine Sikta Dash
Dr. Smruti Ranjan Nayak
Mr. Manas Ranjan Padhi
Mr. Raj Kumar Mohanta
Mr. Rasmi Prakash Swain
Mrs. Sanghamitra Panda
Ms. Sarmistha Senapati
Dr. Jyoti Prakash Giri
Mr. Rakesh Kumar Ray
Mr. Trilochan Sahoo
Dr.Rajalaxmi Tripathy
Itismita Mohanty
Mr. Ikshyaku Behera
Mr. Kshyaman Mohanta

Three-day Workshop
on
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