Indian Institute of Technology Jodhpur

Presents

Industry Day 2023

February 3-4, 2023

भारतीय प्रौद्योगिकी संस्थान जोधपुर

Indian Institute of Technology Jodhpur

॥ त्वं ज्ञानमयो विज्ञानमयोऽसि ॥

ABOUT THE EVENT

IIT Jodhpur was established by the Ministry of Human Resource Development (MHRD), GoI, along with the eight other IITs in 2008. Responding to the changing trends in the industry, IIT Jodhpur has introduced new UG, PG, and research programs in Artificial Intelligence, Data Science, Cyber-Physical Systems, Sensors, Internet of Things and Smart Manufacturing. The Institute now promotes interdisciplinary research in emerging domains, including Space Technology, Internet of Things, Digital Humanities, Autonomous Unmanned Vehicles, Smart Health, Cognitive Science, and Quantum Computing. Special provisions have been created in the curriculum for enabling students (UG, PG, PhD) to pursue entrepreneurship or getting engaged in technology translation as part of their program.

The Institute is excited to share that it has created a vibrant ecosystem to enable sponsored and industrial research opportunities not only for faculties but also for students to contribute to multi-disciplinary projects and R&D for solving problems of industrial interest.

IIT Jodhpur is organizing its Industry Day 2023 on February 3-4, 2023 with an objective to establish links between industries and our academic and research programs. The two day event plans to engage policymakers, scientists, industry experts, and entrepreneurs in meaningful discussions and formulates way forward for stronger industry-academia linkages.

THEMES

AR-VR and Metaverse

Sensors and IOT

Resilient and Smart Infrastructure

Robotics and Mobility

Industry 4.0

Intelligent- and Neuro-marketing

Dependable and Responsible AI

Hydrogen Economy

Technologies for Sustainability

MedTech and Healthcare

KEY OBJECTIVES

- Provide an avenue for potential collaboration opportunities between Industry and IIT Jodhpur.

- Create awareness about different research projects and resources of industry interest being undertaken by IIT Jodhpur.

- Platform to discuss the technological challenges industries are facing.

- Initiation of long term relationships with industries.

INDUSTRY DAY

February 3-4, 2023

Connecting Industries with IIT Jodhpur...

Indian Institute of Technology Jodhpur

॥ त्वं ज्ञानमयो विज्ञानमयोऽसि ॥

AR-VR and Metaverse

4th February, 2023, LHC 308

Research Activities: IIT Jodhpur has an active research group working on following research projects in the domain of AR-VR and Metaverse spanning across both theoretical research and applications.

- Object-based 3D Spatial Audio Rendering for Augmented and Virtual Reality Applications
- Data-driven Haptic Modeling and Rendering of Normal Interactions on Inhomogeneous Viscoelastic Deformable Objects
- Telepresence and Teleaction System for Robot Assisted Dentistry
- Haptic Camera: Inter-relationship between Different Sensing Modalities for Textured Surfaces
- Haptics based Medical Simulator for Abdomen Palpation and Pulse Behavior
- Vadnagar Game Project
- Conscientious Gaming For Mental Health and Therapy
- Design and Development of the Virtual Museums of Rajasthan
- HampiRun: A Metaverse Based Immersive 3D Game
- Animatable Human 3D Surface Reconstruction from Partial 3D Scans
- Reflection Symmetry Based 3D Surface Reconstruction and Restoration from Partial Point Cloud
- Integration of olfactory and visual perception for Immersive multi-modal AR-VR applications

Academic Program: The institute has started M.Tech in AR & VR (offered by School of AI and Data Science) for working professionals from the academic year 2022-23 in collaboration with i-Hub Drishti Foundation, TIH IIT Jodhpur. Following are the key objectives and learning outcomes of the program:

- Produce competent engineers who can design and develop AR and VR applications.
- Knowledge of tools for design and modeling of AR-VR applications and immersive experiences.
- Ability to cultivate technological solutions for addressing growing demands of AR-VR systems
- Solid fundamentals of AR/VR, content creation, hardware design, Rendering, and Animation
- Knowledge of working principles of Game Design, Medical Application, AR/VR based training simulators, Navigation and tracking in AR/VR

For further information, please contact Dr. Amit Bhardwaj (amitb@iitj.ac.in) and Dr. Rajendra Nagar (rn@iitj.ac.in)

Indian Institute of Technology Jodhpur

N.H. 62, Nagaur Road,
Karwar, Jodhpur 342030
Rajasthan (India)

Industry Day 2023

February 03-04, 2023

Sensors and IoT

With the rapid advent of ICT (Information and Communication Technology) and MEMS (Microelectromechanical Systems), the applications of the *Internet of Things* are now practically serving all spectrums of human lives. The key objective of this very session is to strengthen the industry-academia collaboration and explore the potential pathways toward redefining the future in a smarter and more sustainable way.

Invited Speakers:

Dr. Ashwini Aggarwal
Applied Materials India Pvt Ltd.

Dr. Arpan Pal
TCS Research

Dr. Abhilasha Gaur
ESSCI

Mr. Amrit Manwani
Shashra Electronics Pvt Ltd

Keynote Speech 1 by Dr. Ashwini Aggarwal

Enter The Tornado: Scaling Sensors for a Smarter World

Sensor technologies are rapidly evolving and are expected to play a significant role in shaping the future of various industries. From healthcare to imaging to transportation, sensors are being used to collect and analyze data that can be used to improve efficiency, safety and overall performance. In this presentation, we will share the evolving needs and some of the materials and manufacturing innovations that are shaping the markets.

Keynote Speech 2 by Dr. Arpan Pal

Device Edge Computing - towards Embedded Intelligent Systems

In this talk, I will introduce edge computing for implementing AI-driven Intelligent Sensing systems. I will talk about different business-facing application use cases around Machine, Material, and Infrastructure Inspection, People Sensing (Clinical and Non-Clinical), and Remote Sensing & Earth Observation. I will also talk about different AI-Edgification techniques for TinyEdge devices followed by a glimpse into future technologies that will drive this space – like Neuromorphic Computing, Metamaterials, and Nano Sensing.

Panel Discussion

"How to strengthen Industry-Academia cooperation toward futuristic innovation in addressing practical challenges?"

Panelists:

Dr. Ashwini Aggarwal, Dr. Arpan Pal, Shri Amrit Manwani, Dr. Abhilasha Gaur, Prof. Ajay Agarwal, and Dr. Suchetana Chakraborty.

Thematic Highlights of Ongoing Activities at IIT Jodhpur

- Molecular analysis of sweat for evidence-based diagnosis
- Fabric-based Wearable Humidity Sensors
- Identification of organic honey using ultrasensitive and selective nano-sensor
- Optimizing routing heuristics with a meta-heuristics approach in IoT-based VANET
- Blockchain-based security solutions for IoT-enabled Smart City Applications/ Internet of Vehicles
- Structure-Property for Epoxies in Electronic Packaging
- Intelligent CMOS Image Sensor for improved power efficiency and battery life
- IoT-based emission monitoring
- Inertial Sensing to Monitor the Involvement of Silent Listeners during an Online Interaction
- Efficient Method for automating non-smart devices using IoT-enabled Smart Switch
- Prakriti- Bridging IoT and Mobile sensing for the conservation of local biodiversity
- Electrochemical coliform sensors and its uses for water monitoring
- Chemiresistive VOC/gas sensors for Environmental Monitoring
- Predictive Maintenance and Quality Control in industries under Industry 4.0
- Freestanding Borophene and it's hybrids
- Salivary Analysis for Oral Healthcare
- Micro electrode-based device for cartilaginous tissue reshaping

Resilient and Smart Infrastructure

INDUSTRY DAY
February 3-4 2023

Connecting Industries with IITJ

Resilient and Smart Infrastructure

Feb 3rd 16:30-17:15, Jodhpur Club Auditorium
- **Theme Keynote lecture by Mr. Rajendra Inani (Tata Projects)**

Feb 3rd 17:15-17:45, Jodhpur Club Auditorium
- **IITJ's ongoing research and possible collaborations in the theme Dr. Ranju Mohan (IIT Jodhpur)**

Feb 3rd 17:45-18:30, Jodhpur Club Auditorium
- **Panel Discussion on the theme
Prof. Chandan Gosh (NIDM)
Mr. Ashish Deshpandey (Buro Happold)
Dr. Chitro Majumdar (RsRL)
Mr. Manish Parihar (WRD, Rajasthan)
Dr. Debasis Das (IIT Jodhpur)
Dr. Ravi Yadav (IIT Jodhpur)**

Moderators
**Dr. Ravi Prakash (IIT Jodhpur)
Dr Saran Aadhar (IIT Jodhpur)**

Resilient and Smart Infrastructure @ IIT Jodhpur

IIT Jodhpur envisions itself as one of the leading academic institutes transforming conventional infrastructure to be intelligent through transdisciplinary research and technology development. Following is the summary of academic, research and technology development aspects of Resilient and Smart Infrastructure @ IIT Jodhpur .

- UG specialization in smart infrastructure featuring unique courses such as Digital Twins, AI&ML in Infrastructure Engineering, Cyber-physical systems.
- Thematic centres: Centre for Technology, Foresight and policy and Centre for
- Intelligent Infrastructure

Ongoing Research (Sponsored and Non-sponsored)
- BIM (Advanced BIM models, LCA, Rating systems)-Dr. Ravi Prakash
- Intelligent Transport Systems- (Dynamic traffic assessment, AR-VR applications)-Dr. Ranju
- Intelligent Transport Systems- (Vehicular Adhoc networks)-Dr. Debasis Das
- Climate change and Infrastructure resilience-Dr. Saran
- Smart grid systems-Dr. Ravi Yadav
- Resilient Offshore Infrastructure and dune migration studies –Dr. Pradeep Dammala
- Structural Health Monitoring of Bridge Infrastructure-Dr. Amit Rathi

ROBOTICS AND MOBILITY SYSTEMS
IIT JODHPUR

Inter-Disciplinary Research Platform (IDRP) on Robotics and Mobility Systems (RMS) focuses on cutting-edge technology development in the areas of:

- Mobile Robots
- Unmanned Vehicles
- Electric Vehicles
- Motion Planning

- Computer Vision
- AI, ML, Computer Vision
- Security

- Vehicle Dynamics and Control
- Battery Management Systems
- Communication and Networking
- Perception and Navigation

M. Tech Regular [11]

M. Tech in RMS
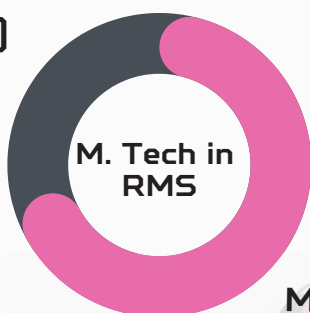
M. Tech Executive [27]

Academic Programs

- Ph. D.
- M. Tech (With Micro-specializations in)
  - Unmanned Aerial Vehicles
  - Autonomous Mobile Robots
  - Electric Vehicles
- B. Tech Specialization in Robotics

Highlights:

- IDRP RMS houses 24 faculties
- Associated departments include Mechanical, Electrical, Civil and Infrastructure, Computer Science, Chemical, etc.
- DRDO CoE for Omni Mobility Systems
- Indigenous auto pilot system for UAVs
- Instructional lab for Unmanned Vehicles

Research Facilities

- Unmanned Vehicles
- Mobile Robots and Control
- Electric Vehicles
- Haptics
- Vehicular Networks
- Mobility Systems
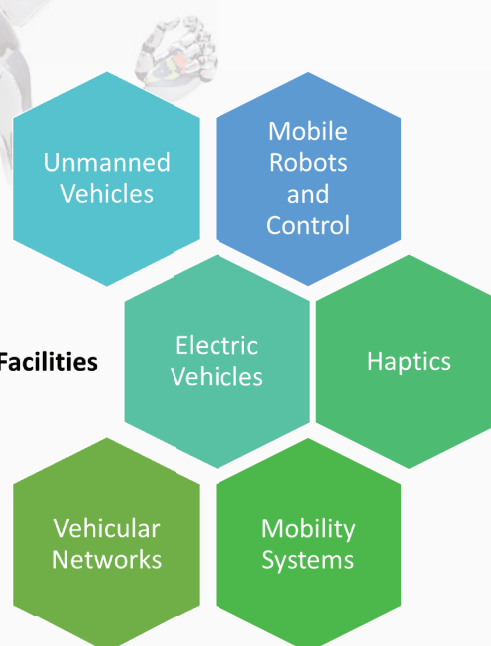
Glimpse of R&D Portfolio

- Object Detection using RGB Camera and Single Channel Lidar.
- ML Execution for Mobility Systems under Tight Resource Constraint.
- Design and Development of Indigenous On-board Autopilot and Vision-based Navigation Systems for Autonomous Flight of Hover Capable Rotary-wing Vehicles.
- Isothermal enclosure design for characterizing Li-ion cell.
- Real Time 3D Scene Reconstruction and Localization of Autonomous Ground Vehicle.
- Haptics Based Human Abdomen Simulator.

For more details, please visit: https://iitj.ac.in/rm/, or email your queries to rm@iitj.ac.in

IIT JODHPUR

Presents

INDUSTRY DAY

FEBRUARY 3-4 | 2023

Venue: LHC 308

INTELLIGENT AND NEUROMARKETING

KEY NOTE SPEAKER

PANEL MEMBERS

Dr. Jane Leighton

Vice President
NielsenIQ BASES

Mr. Bhupesh Dinger

Director
Enrich

Ms. Diya SIngh

Founder and CEO
Neurohook

KEY RESEARCH AREAS

- Eye Tracking
- EEG (Electroencephalogram)
- GSR (Galvanic Skin Response)
- Facial Coding
- Implicit Response Test
- EMG (Electromyography)
- Facial Expressions
- Pupillometry

COORDINATORS
Prof. Sangeeta Sahney (IIT J)

Dr. Anuj Pal Kapoor (IIT J)

Project Themes

- Deepfake & Attack Detection
- Bias Mitigation
- Privacy-preserving AI
- Psycho-social Impact Analysis
- Community Policing
- Emergency Monitoring
- Explainability & Efficiency
- Commonsense & Factual Reasoning

Responsible AI

Societal Ethics

Ethics Framework

AI Governance

Systemic AI Transparency

Algorithmic Explainability & Interpretability

Source: Cognilytica

Industry Day 2023 @ IIT Jodhpur:

Theme: Dependable and Responsible AI
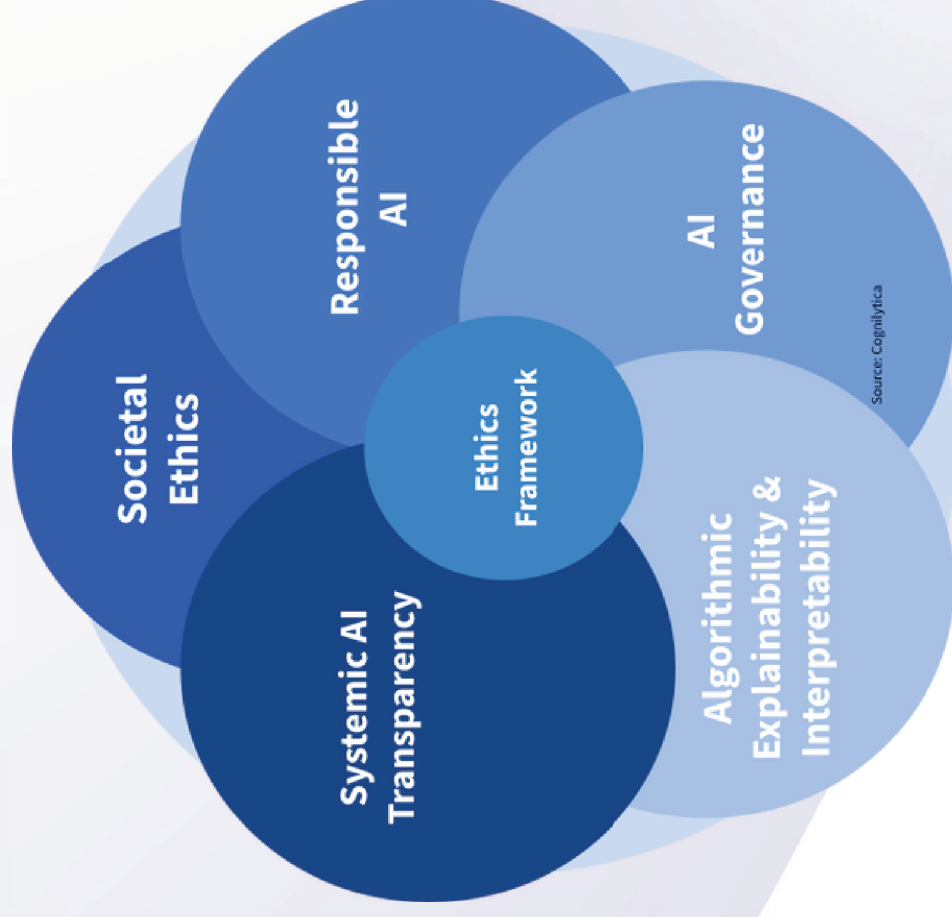
Departments & Schools Working in the Area

- Computer Science and Engineering
- Electrical Engineering
- Mathematics
- School of AI and Data Science
- School of Liberal Arts
- School of Management and Entrepreneurship

Major Publications @

Journals

- TPAMI
- TCSS
- IEEE Trans. Biometrics, Behavior & Identity Science
- IEEE Trans. Technology & Society
- Remote Sensing Applications: Society and Environment
- …

Conferences

- EMNLP
- AACL-IJCNLP
- ICCV
- ECCV
- ICPR
- IEEE FG
- IJCB
- AAAI Conference on AI
- ICASSP
- …
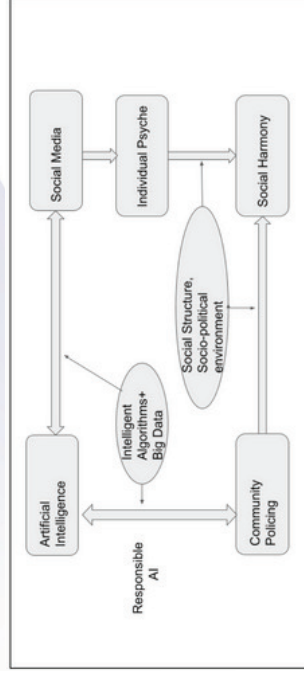
Some Application Areas

- Security & Surveillance
- Healthcare
- Natural Language Processing
- Dependable AGI
- AR-VR
- Image and Video Analysis

Funding & Collaborations

- Accenture
- DRDO
- DST
- ICSSR
- MEITY
- Meta
- Microsoft
- Ministry of Home Affairs
- SERB
- TIH iHub-Drishti
- Nvidia

Courses & Activities

- Dependable AI
- Ethics, Policy, Law and Regulations in AI
- Winter School on Responsible AI - Dec 2022
- Conference on Next-gen AI: Inspiration from Brain Science - Jan 2023

A deepfake of Russian President Vladimir Putin claiming that Russia has won the war is circulating online today as well.

The deepfake Putin even says that Ukraine has recognized Crimea as Russian territory.

A deepfake of Ukrainian President Volodymyr Zelensky calling on his soldiers to lay down their weapons was reportedly uploaded to a hacked Ukrainian news website today.

Industry Day
"MedTech & Healthcare"

A Journey Through Medical-Technology

IDENTIFY **INVENT** **IMPLEMENT**

STAGES

| 1 NEEDS FINDING | 2 NEEDS SCREENING | 3 CONCEPT GENERATION | 4 CONCEPT SCREENING | 5 STRATEGY DEVELOPMENT | 6 BUSINESS PLANNING |

PROJECT LAUNCH
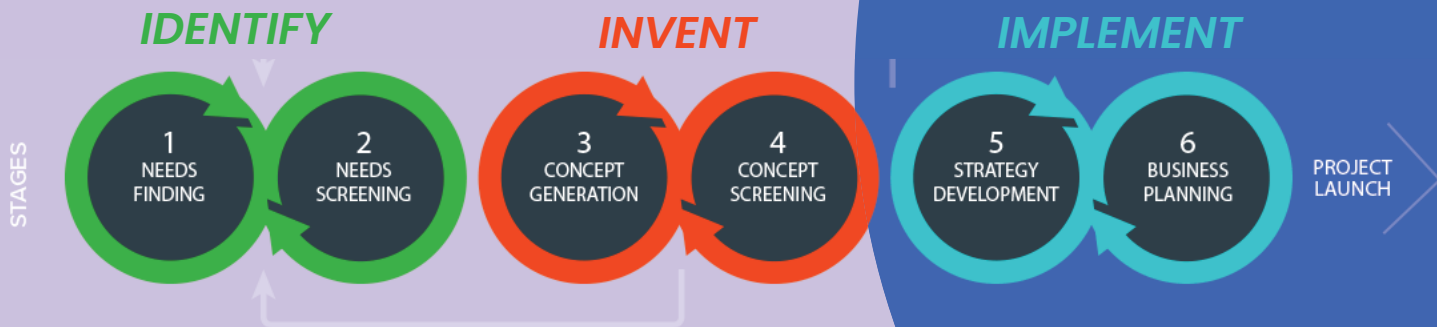
Salient Features of Program

1. Collaboration of Engineers & Doctors as Students & Faculties

2. Deep Tech Innovation & Startup Culture

3. One Semester long Clinical Immersion at AIIMS Jodhpur

4. One faculty each, from IIT-J & AIIMS-J jointly mentor the student.

5. Promising innovations/ research are supported by Biodesign Fellowship to transform the project into Startup.

Achievements (2022-2023)

- 2 PMRF Fellowship
- 1 BIRAC Big Grant
- 1 MSME Grant
- 5 Publications by Faculty-Student Teams
- 2 Students won NBEC 2022 conducted by BIRAC & C-Camp
- 1 Award for Technology Readiness. BETIC, IIT Bombay, 2022

7 Startups incubated, arising out of the joint programs in Medical Technologies

Startup Culture
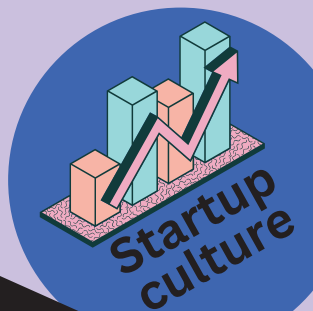
TECHNOLOGIES
FOR SUSTAINABILITY

Paver Blocks

Smart Water grid

SMART SUSTAINALBE MATERIALS

- Plastic paver blocks can be used for landscaping in low traffic areas. Addition of rice husk straw reduces plastic shrinkage and enhances the compressive strength.
- IITJ's generated Plasma activated water (PAW) has a low pH value and is acidic in nature, with high conductivity, nitrite concentration, nitrate concentration, and nil concentration of hydrogen peroxide.
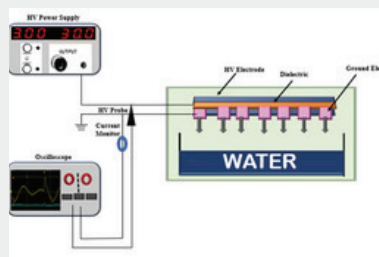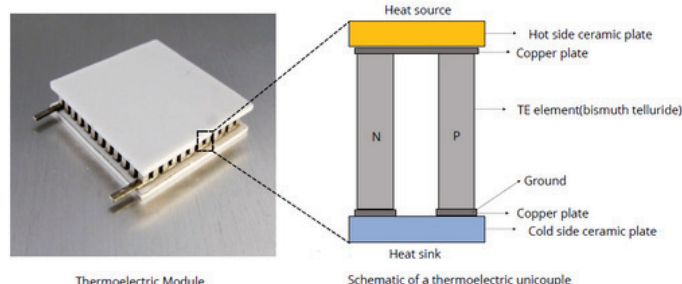
IITJs PAW system
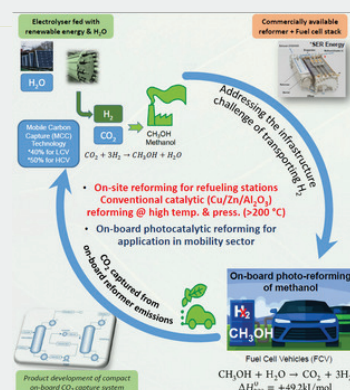
Hydrogen carriers based circular carbon economy

MULTIPHYSICS MODELLING THERMOELECTRIC GENERATOR

Thermoelectric Module

Schematic of a thermoelectric unicouple

SUSTAINABLE ENERGY SYSTEMS

- Encapsulated PCM for sustainable energy storage applications. The chemical stability is improved and conductive hat transfer has been enhanced.
- Multiphysics modelling of thermoelectric device for sustainable power generation.
- Development of 3D dynamic model of packed bed thermal energy storage. It has alumina bead as a packing material and air as a heat transfer fluid to simulate charging

SMART TECHNOLOGICAL INTERVENTIONS

- IoT enabled smart water supply monitoring system keeping a track of real time flow, pressure and water quality data.
- Smart health care : Application of an artificial nose as a point of care diagnostics

INDUSTRY DAY IIT JODHPUR
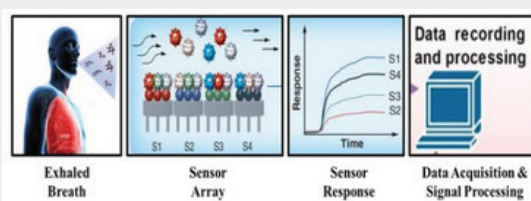
Dr. Prashant Kumar Gupta: (Email: guptapk@iitj.ac.in)
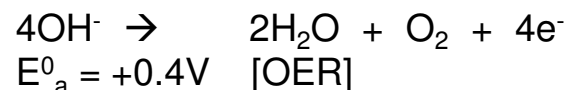**Department of Chemical Engineering**
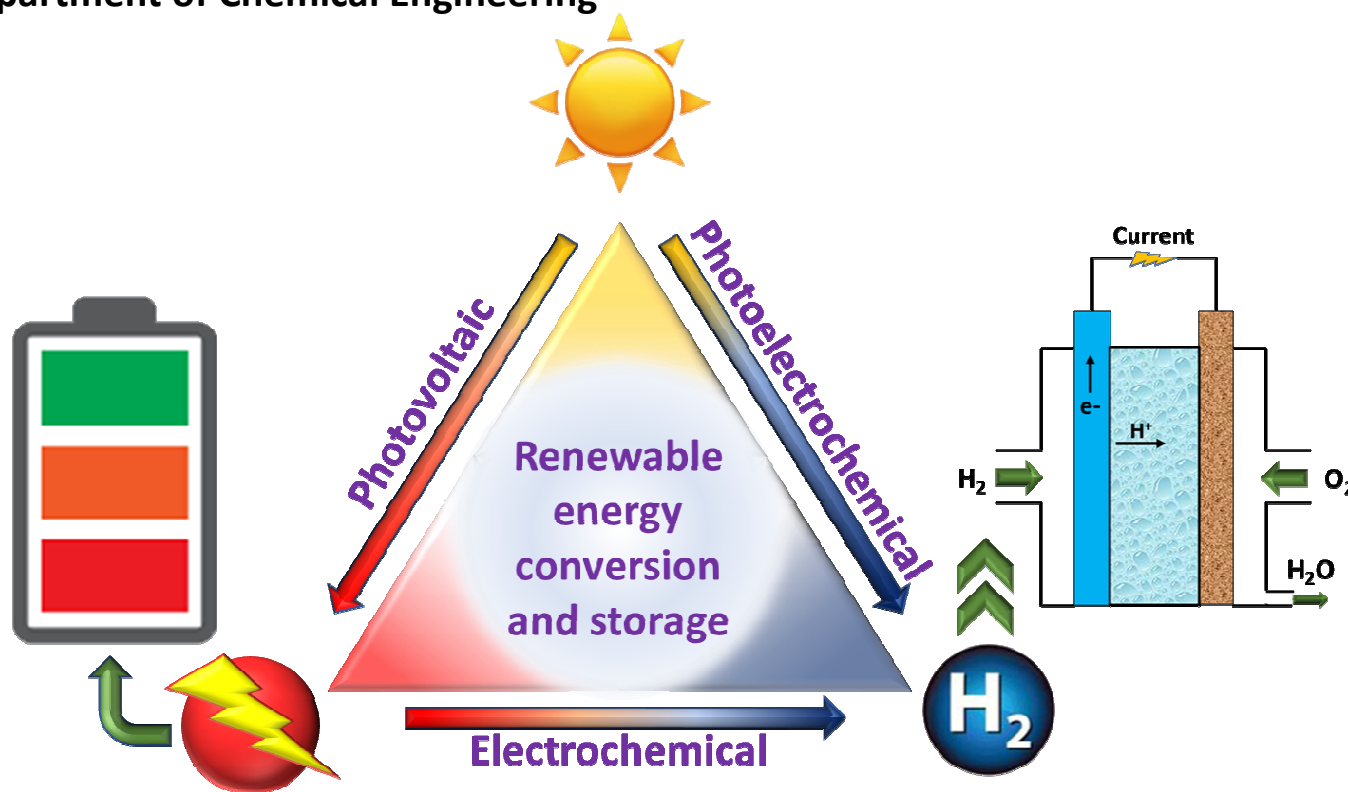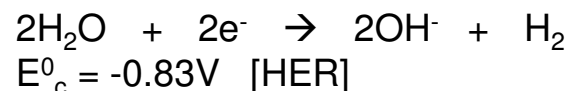
1. Scaling Volcano in Electrocatalyst for Hydrogen Production
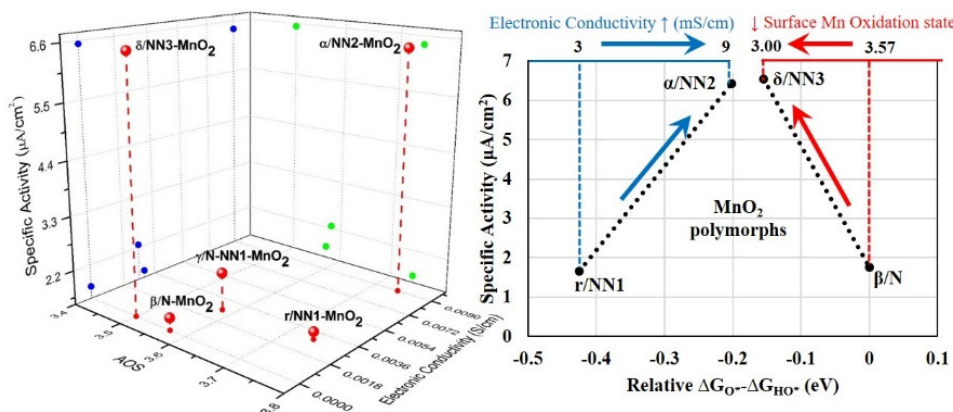
Water electrolysis is thermodynamic uphill process (ΔG +237.2 kJ/mol) with E^0_{cell} = 1.23V

In Alkaline medium:

At Anode:

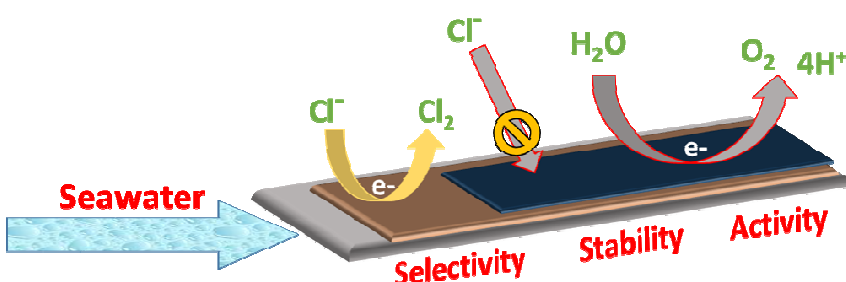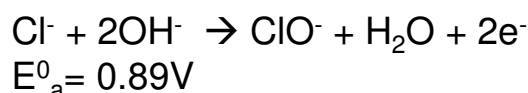$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$

E^0_a = +0.4V   [OER]

At Cathode:

$2H_2O + 2e^- \rightarrow 2OH^- + H_2$

E^0_c = -0.83V   [HER]

2. Non-Precious Metal Oxides as an Anode for Seawater Electrolysis

Presence of electrochemically active ions (Cl^-, Br^-, SO_4^- etc) and insoluble precipitates are the challenges. Chloride ions have the great ability to interfere with OER at the anode

Alkaline medium:

$Cl^- + 2OH^- \rightarrow ClO^- + H_2O + 2e^-$

E^0_a = 0.89V

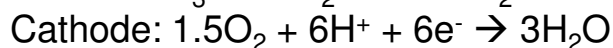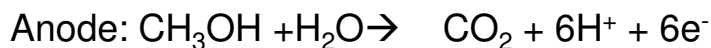**Dr. Angan Sengupta: (Email: angan@iitj.ac.in)**
Department of Chemical Engineering

1. Computational Approach For Designing Efficient DMFCs

Anode: $CH_3OH + H_2O \rightarrow CO_2 + 6H^+ + 6e^-$
Cathode: $1.5O_2 + 6H^+ + 6e^- \rightarrow 3H_2O$

- Problems associated with DMFCs
  - Poor Anode Kinetics: Already addressed using Pt-Ru catalyst
- Methanol crossover
  - Cause cathode poisoning
    - Can be addressed by designing novel separating membranes
      - Should not affect proton transfer through the membrane
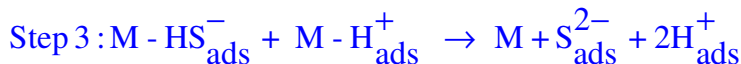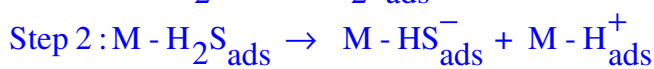   - Should not decrease fuel cell energy efficiency
- Half Cell Reaction
  - Used for **Green Hydrogen Production**
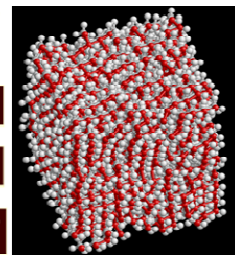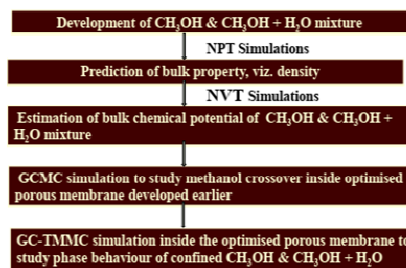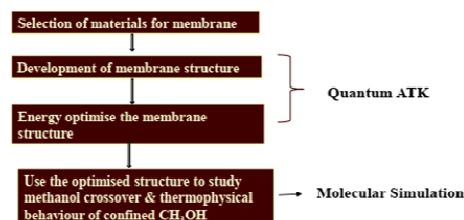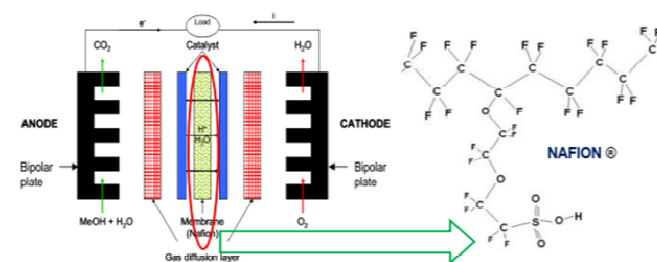
Modelling & Simulation Methodology

2. Mitigating Challenges in H_2 Production & Storage

- Another less Energy penalty associated Route for Green H_2 production
- Dissociation of H_2S on metal surface $\rightarrow$ Also target Environmental Pollution

$$\text{Step 1}: M + H_2S \rightarrow M\text{-}H_2S_{ads} \quad (M = \text{metal surface})$$
$$\text{Step 2}: M - H_2S_{ads} \rightarrow M - HS^-_{ads} + M - H^+_{ads}$$
$$\text{Step 3}: M - HS^-_{ads} + M - H^+_{ads} \rightarrow M + S^{2-}_{ads} + 2H^+_{ads}$$

$$\Delta G^o = 33.44 \text{ kJ/mol} < \Delta G^o_{H_2O} = 237.19 \text{ kJ/mol}$$

- At low to moderate temperature $\rightarrow$ Hydrogen adsorbed on metal surface
- At high temperature $\rightarrow$ Molecular Hydrogen formed
- Molecular Hydrogen associated challenges
  - Enters defects & cracks of Metal Surfaces at hight T & P
    - Metal Surface of Photocatalysts & Storages
    - Results Hydrogen Embrittlement & Safety Issues

Molecular & Continuum Scale Modelling, Simulations

WAY THROUGH
- Quantify H_2 adsorption on metal surfaces
- Quantify & Understand H_2 diffusion mechanism through cracks & defects

*Wen et al., Applied Surface Science, 2019*
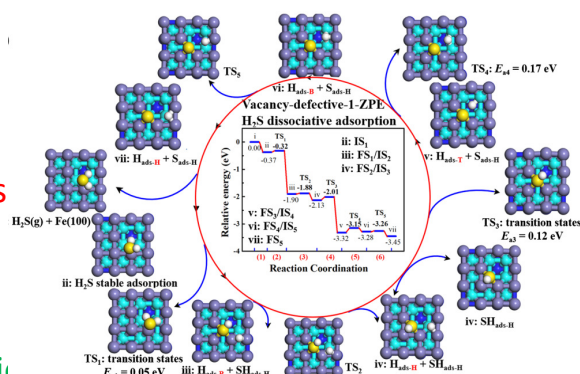
Dr. Shahab Ahmad: (Email: shahab@iitj.ac.in)
Department of Physics

Photovoltaics Assisted Hydrogen Generation

Solar assisted water splitting technology has great potential to produce H_2 due to abundant solar energy and water on the surface of the earth. However solar to hydrogen conversion efficiency of the reported solar water splitting system is still far below the target efficiency of 10% for large-scale applications due to poor stability of photoelectrodes and inferior performance of photocatalysts. Hence to boost the solar to hydrogen conversion efficiency, it is necessary to develop new solar water splitting systems with high photocatalytic activity, stability and broad light absorption capabilities. Due to extremely good light absorption coefficient, optoelectronic properties and PV power conversion efficiencies of metal halide perovskites we explore them as a photocathodes for H_2 production applications.

We have demonstrated triple-cation based perovskite with AZO protective as well as electron transport layer which resulted in 5-fold expansion of the device lifetime that can last up to 18 hours in the buffer solution and deliver faradic efficiency of H_2 generation of above 80%. We have also developed bias-free water splitting system using CsFAMA mixed I-Br perovskite photocathode and robust $BiVO_4$ photoanode based back-to-back photoelectrochemical (PEC) tandems with 1 cm^2 active area which showed remarkable stability of up to 20 h and corresponding solar-to-hydrogen conversion efficiency of ~0.4 %.


Solar Water Splitting
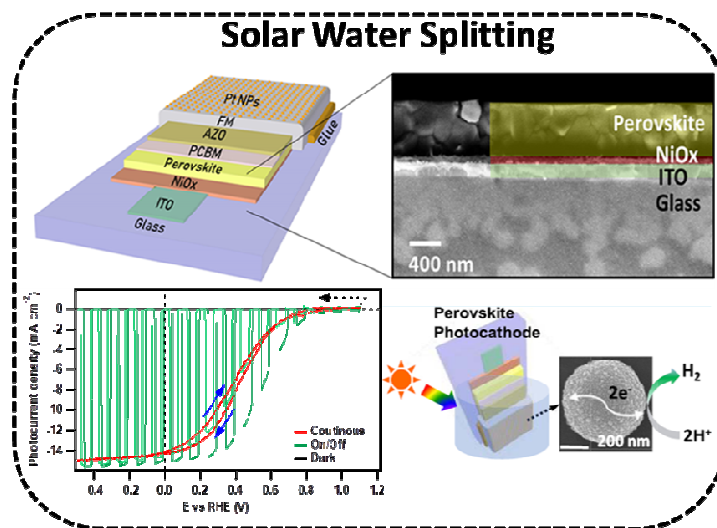
Dr. Hardik Kothadia: (Email: hardikkothadia@iitj.ac.in)
Department of Mechanical Engineering

Compact Metal Hydride Based Hydrogen Storage and Transport System

Type of Storage	Tank Volume	Pressure Requirement	Temperature Requirement	Storage Capacity
High-Pressure Gas Storage	280 L	40 Bar	0 ℃	1 kg
Very High-Pressure Gas Storage	50 L	300 Bar	0 ℃	1 kg
Liquid Storage	15 L	1 Bar	-252 ℃	1 kg
Metal Hydride Based Storage	~25 L	~30 Bar	20 ℃	1 kg
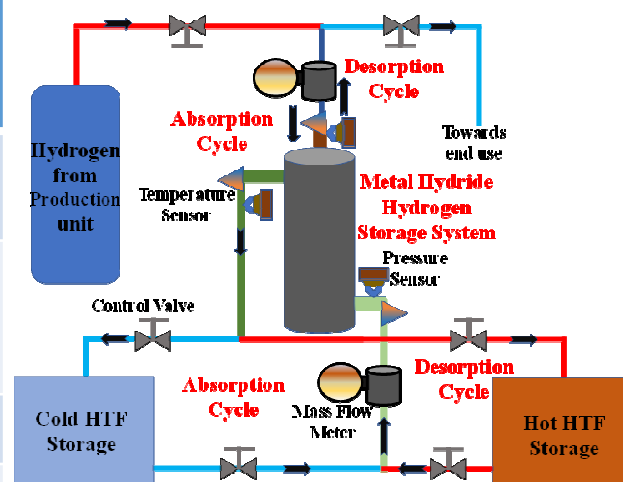
NOTES

NOTES

VISIT US

PATRON

Prof. Santanu Chaudhury
Director IIT Jodhpur

✉

Prof. Manoj Choudhary
Dean (IR,AR and CR)

Dr. Gaurav Bhatnagar
Associate Dean (IRO)

🌐

http://home.iitj.ac.in/~id2023/

For more Details

📍 NH 62 Nagaur Road, Karwar, Jodhpur-342030, Rajasthan.