ABSTRACT BOOK

2nd International Conference on Technology Driven Climate Action (CLIMATECH) - 2025

January 16 - 17, 2025

Department of Physics
Department of Telecommunications Engineering
NED University of Engineering & Technology

2ND INTERNATIONAL CONFERENCE ON TECHNOLOGY DRIVEN CLIMATE ACTION 2025

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Reon Energy is a leading Cleantech company deploying Intelligent Renewable Energy Microgrids across South Asia, GCC & African region. We help Commercial & Industrial customers maximize renewable energy in their mix, improving overall affordability, reliability and sustainability of energy.

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ABOUT OUR SPONSORS

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Ernst & Young (EY) is a global leader in assurance, tax, transaction, and advisory services. With a network of over 300,000 professionals in more than 150 countries, EY is committed to building a better working world by helping clients navigate complex challenges and seize opportunities. The firm provides insights and quality services that help build trust and confidence in the capital markets and economies worldwide. EY's global reach and integrated approach enable it to deliver exceptional client service and innovative solutions across industries.

In Pakistan, EY operates with a strong presence, offering a comprehensive range of services including assurance, tax, Consulting and transaction advisory services. EY Pakistan is dedicated to helping businesses grow and succeed by providing tailored solutions that address local market dynamics and regulatory requirements. The firm leverages its global expertise and local knowledge to support clients in achieving their strategic objectives, enhancing performance, and managing risks. EY Pakistan is committed to contributing to the country's economic development and fostering a culture of integrity and excellence.

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Mahmood Cotton Ginners is a prominent company in the cotton ginning and textile industry in Pakistan. It specializes in processing raw cotton into high-quality ginned cotton, which is a vital input for the textile industry. Known for its state-of-the-art ginning facilities and adherence to quality standards, Mahmood Cotton Ginners supports both local and international markets. Its commitment to innovation, efficiency, and sustainability has helped it establish a reputation for reliability in the cotton supply chain.

MESSAGE

Patron in Chief

PROF. DR. SAROSH HASHMAT LODI

Vice Chancellor,
NED University of Engineering and Technology

It is with distinct honour that I welcome you all to the 2nd International Conference on Technology-Driven Climate Actions (CLIMATECH 2025). This event marks a pivotal moment in our collective efforts to address the global climate crisis, uniting academia, industry, and policymakers under a shared vision of sustainable development. As engineers, scientists, and thinkers, we bear a unique responsibility to devise technology-driven strategies that mitigate environmental harm and promote resilience in the face of these adversities.

At NED University of Engineering and Technology (NEDUET), we have implemented a range of initiatives to address climate change and promote sustainability. NEDUET has signed the Talloires Declaration to become Carbon Neutral Campus and has brought Pakistan as a member of Talloires Signatory List. We are committed to achieve carbon neutral campus by 2030 through energy-efficient infrastructure and extensive tree plantation and urban forestry projects. Besides, our sustainable transportation initiatives, including Healthy Fridays, promote low-carbon mobility. CLIMATECH 2025 underscores the critical role that engineering communities can play in combatting climate change. I am confident that the exchange of ideas and research presented during CLIMATECH 2025 will serve as a beacon of hope and progress for our planet.

Lastly, as the conference Patron-in-chief, I would like to extend my heartfelt gratitude to the Department of Telecommunications Engineering and the Department of Physics for their remarkable efforts in organizing this conference. Your dedication and vision have laid the foundation for a platform that will inspire and catalyze meaningful climate action. I also wish to express my sincere appreciation to our sponsors Dawlance Pakistan, Reon Energy, Ernst and Young, and Mahmood Cotton Ginners.

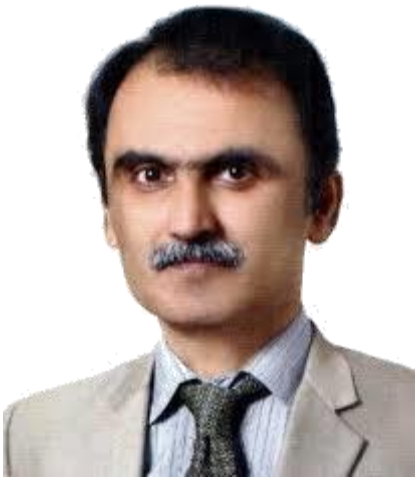
To all the researchers, practitioners, and participants contributing to this conference, thank you for your valuable insights and efforts. Together, let us harness the power of technology and innovation to build a sustainable and equitable future for generations to come.

MESSAGE

Co-Patron

PROF. DR. MUHAMMAD TUFAIL

Pro Vice Chancellor,
NED University of Engineering and Technology



It gives me immense pleasure to welcome you all to CLIMATECH 2025 – The 2nd International Conference on Technology-Driven Climate Actions, jointly organized by the department of Physics and department of Telecommunications Engineering at NED University of Engineering and Technology.

As we gather here, it is crucial to understand that the climate crisis represents one of the most critical challenges humanity has ever faced. Characterized by rising global temperatures, melting ice caps, increasing sea levels, and the frequency of extreme weather events these changes are driven primarily by human activities, which have led to unprecedented levels of greenhouse gas emissions in the atmosphere. Therefore, all of us have this obligatory duty to work collaboratively towards the climate actions.

At the NED University of Engineering and Technology, we are playing our part by actively promoting the United Nations Sustainable Development Goals (SDGs), with a keen focus on clean energy, sustainable cities, and climate action. To enhance energy efficiency, we have implemented measures to reduce consumption and increase the use of renewable energy sources on campus. Waste management practices have been improved to minimize waste generation and promote recycling and proper disposal. In education and research, NED University integrates sustainability and climate change topics into the curriculum and encourages projects focused on environmental sustainability. The university also engages with the local community to raise awareness about climate change and promote sustainable practices. These comprehensive efforts highlight NED University's dedication to addressing climate change and fostering sustainability both on campus and in the wider community. CLIMATECH 2025 is also one such initiative which is envisioned to provide an interactive platform for effective collaboration between researchers, industrialists, academicians and policy makers to address the climate actions.

I am confident that the knowledge and insights acquired over these two days will be instrumental in crafting a future that can endure the challenges of time.

MESSAGE

Co-Patron

PROF. DR. SAAD AHMED QAZI

Dean Faculty of Electrical and Computer Engineering,
NED University of Engineering and Technology

It is with great honour that I welcome you all to CLIMATECH 2025 – The 2nd International Conference on Technology-Driven Climate Actions, hosted by the NED University of Engineering and Technology. This conference represents a vital opportunity to address the global challenge of climate change, a crisis that demands urgent, innovative, and collaborative solutions.

The impacts of climate change—ranging from extreme weather events to resource depletion—are intensifying and pose existential threats to ecosystems and human societies. Tackling these challenges requires multidisciplinary approaches where electrical and computer engineering play a transformative role. Innovations in renewable energy systems, smart grids, energy-efficient technologies, and climate-resilient infrastructure are key areas where our field can make significant contributions. Furthermore, advancements in artificial intelligence, IoT, and data analytics empower us to develop predictive models and optimize resources, paving the way for sustainable development.

Through this conference, we aim to share insights and ideas that could inspire future collaborations and drive meaningful change. I am confident that the collective knowledge and discussions fostered here will catalyze innovations that address pressing climate challenges.

Finally, I extend my heartfelt gratitude to our sponsors Dawlance Pakistan, Reon Energy, Ernst and Young, and Mahmood Cotton Ginners. Special thanks to our platinum sponsor Dawlance, Pakistan to show their commitment for promoting sustainabile practices is manifested through their Sustainability Hackathon. Also, I would like to congratulate the conference organizers for curating this important platform for knowledge exchange and collaboration. Your efforts in bringing together researchers, practitioners, and industry leaders are commendable and critical to advancing technology-driven climate actions.

My best wishes to all participants for a successful and impactful conference. May the outcomes of this event lead to a more sustainable and equitable future for all.

MESSAGE

Co-Patron

PROF. DR. NOMAN AHMED

Dean, Faculty of Architecture & Sciences
Chairholder and Network Coordinator, UNESCO
Chair for Sustainable Urban Regions
NED University of Engineering and Technology

Dear Esteemed Participants,

It is my great honor and privilege to welcome you to CLIMATECH 2025, the 2nd International Conference on Technology-Driven Climate Actions, hosted by NED University of Engineering and Technology. The significance of this conference cannot be overstated as we face the urgent need to address climate change, one of the most critical challenges of our time.

At NED University of Engineering and Technology, in my role as the Chairholder and Network Coordinator for the UNESCO Chair for Sustainable Urban Regions, I am deeply committed to fostering sustainable urban development through research, education, collaboration, and advocacy. Our work at NED University aims to integrate sustainability into our academic and research activities, build capacity, and promote interdisciplinary approaches to solve urban sustainability challenges.

Through this conference, I am certain that the discussions and presentations would inspire new ideas and collaborative efforts to drive meaningful climate actions.

I would like to extend my heartfelt gratitude to the conference organizing team for their dedication and hard work. Best wishes to all participants for a successful and inspiring conference.

Thank you.

MESSAGE

Conference Chair

PROF. DR. M. IMRAN ASLAM

Chairman, Department of Telecommunications Engineering,
NED University of Engineering and Technology

Dear Esteemed Participants,

It is my great pleasure to welcome you to the 2nd International Conference on Technology-Driven Climate Actions, CLIMATECH 2025, hosted by NED University of Engineering and Technology. This gathering of brilliant minds underscores the critical importance of addressing the multifaceted challenges posed by climate change through innovative technological solutions.

The global climate crisis has emerged as one of the most pressing challenges of our time, manifesting in extreme weather events, rising sea levels, and widespread ecological degradation. Recently, the catastrophic events like hurricanes in the United States, floods in Kyhber Pukhtunkhwa and recurrent droughts in Thar, Pakistan, speak volumes of the impacts of climate change and how it is being felt across the globe.

By integrating technology-driven climate actions into policy frameworks, we can work towards a more sustainable and resilient world. Hence, CLIMATECH 2025 is an initiative that aims to bring together experts, policymakers, stakeholders, researchers, and students to address the climate actions. The 2-day program including keynote addresses and panel discussion would pave way for meaningful and thought-provoking discussions along with technical sessions to address climate-related challenges through technological advancements.

As the conference chair, I extend my heartfelt gratitude to our sectoral collaborators: British Council, UNESCO Chair, IEEE young professionals and our academic collaborator, the University of West of Scotland, whose support and contributions have been instrumental in making this event a success. I also want to commend the entire organizing committee for their outstanding dedication and hard work in making this event a success. A special thank you goes to our sponsors, Dawlance Pakistan, Reon Energy, Ernst and Young, and Mahmood Cotton Ginners. This event was not possible without their financial support.

Together, let us embark on this journey towards a sustainable future, leveraging our collective expertise and passion for technology-driven climate actions.

MESSAGE

Conference Co-Chair

DR. IRFAN AHMED

Chairperson, Department of Physics
NED University of Engineering and Technology

Dear Esteemed Participants,

It is my privilege to welcome you to CLIMATECH 2025, the 2nd International Conference on Technology-Driven Climate Actions, organized by NED University of Engineering and Technology. This conference comes at a critical juncture as we face the increasingly urgent challenge of climate change, which poses significant risks to our ecosystems, economies, and societies.

The pressing need for climate action is underscored by the frequency and intensity of extreme weather events, rising sea levels, and the loss of biodiversity. To address these multifaceted challenges, we must adopt and implement sustainable practices that can mitigate the adverse effects of climate change. It is imperative that we take immediate and decisive action to secure a sustainable future for generations to come.

Engineering communities have a pivotal role in this endeavor. By leveraging their expertise and innovative spirit, engineers can develop and deploy cutting-edge technologies that reduce greenhouse gas emissions, enhance energy efficiency, and promote renewable energy sources. Their contributions are essential in creating resilient infrastructures and sustainable urban environments that can withstand the impacts of climate change.

Through CLIMATECH 2025, we aim to bring together leading researchers, practitioners, and thought leaders from around the world to share their insights and breakthroughs. The knowledge and discussions generated at this conference will undoubtedly inspire new ideas and collaborative efforts to drive effective climate actions.

I would like to extend my heartfelt gratitude to the entire organizing team for their dedication and hard work in making this conference a reality. Your efforts have been instrumental in bringing together a diverse and talented group of individuals committed to addressing climate change.

To all the attendees, thank you for being a part of this important initiative. Your participation and engagement are crucial in our collective mission to combat climate change and promote sustainability.

MESSAGE

Conference Co-Chair

DR. GHOUS BAKHSH NAREJO

Chairperson, Department of Electronic Engineering
NED University of Engineering and Technology

As we gather for CLIMATECH 2025, the urgency of addressing climate change has never been clearer as of today. Rising global temperatures, dwindling resources, and unpredictable weather patterns underscore the need for immediate, innovative climate actions and sustainable practices. Engineering communities are uniquely positioned to tackle these challenges by designing technologies that minimize environmental impact, optimize resources, and build resilience against climate adversities.

Through CLIMATECH 2025, we seize the opportunity to share ideas and insights that can foster future collaborations and pave the way toward a resilient and sustainable future. I extend my heartfelt gratitude to the organizing team for their dedication and to all attendees for contributing to this vital dialogue.

Together, let us shape a sustainable future.

Thank you.

MESSAGE

Conference Secretary

DR. HIRA MARIAM

Assistant Professor,
Department of Telecommunications Engineering
NED University of Engineering and Technology

Dear Esteemed Colleagues, Participants, and Sponsors,

It is with great pleasure that I welcome you to CLIMATECH 2025, the 2nd International Conference on Technology-Driven Climate Actions, organized by NED University of Engineering and Technology.

As we gather to discuss the pressing climate challenges of our time, we recognize the urgency of implementing sustainable practices and climate actions to safeguard our planet for future generations. It is not merely a call to action but a moral imperative. And, the role of our engineering fraternity is pivotal in addressing these challenges through technological advancements, innovative solutions, and sustainable practices. By fostering collaboration, innovation, and a commitment to sustainability, we can significantly contribute to achieving climate resilience and environmental sustainability.

As the conference secretary, I am deeply grateful to our generous sponsors, whose contributions have made this conference possible. Your support enabled us to bring together brilliant minds and foster meaningful discussions that will drive climate action.

I would also like to extend my heartfelt gratitude to the organizing team for their tireless efforts in ensuring the success of this event. Your dedication and hard work are truly commendable. Finally, a sincere thank you to all the attendees for your participation and commitment to addressing the critical issue of climate change. Your presence and contributions are invaluable.

Together, let us drive technological innovations and sustainable solutions that will lead us to a resilient and climate-friendly future.

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ABOUT CLIMATECH 2025

The 2nd International Conference on Technology Driven Climate Action (CLIMATECH- 2025) is a pioneering global forum dedicated to exploring the intersection of technology and environmental stewardship. With the theme "Where Innovation Meets Environmental Stewardship," this two-day event, scheduled for January 16-17, 2025, at NED University of Engineering and Technology (NEDUET), Karachi, will bring together leading scientists, engineers, policymakers, and entrepreneurs to tackle the pressing challenge of climate change. Jointly organized by the Department of Physics and the Department of Telecommunications Engineering, the conference will provide a collaborative platform featuring invited talks, panel discussions, and technical presentations on key areas such as climate change impacts, and innovation for a sustainable future.

OBJECTIVES

CLIMATECH-2025 aims to drive impactful action against climate change by promoting innovative technological solutions for sustainability and resilience. The conference will unite experts from various fields—science, engineering, policy, and business—to collaboratively tackle pressing climate challenges and explore the multifaceted impacts of climate change on ecosystems, health, and economies. It will showcase advancements in renewable energy, carbon reduction, and sustainable practices while facilitating critical discussions on climate policy and governance, emphasizing Pakistan's role in global efforts. Additionally, CLIMATECH-2025 will raise awareness of environmental radioactivity and empower the next generation with the knowledge and tools needed to combat climate change effectively.

DAWLANCE SUSTAINABILITY HACKATHON

Co-Organized by Dawlance and NED University of Engineering and Technology

As part of the ClLIMATECH-2025 Conference, the Dawlance Sustainability Hackathon, held on January 16th–17th, 2025, brought together some of the brightest and most innovative minds to address critical challenges in sustainability. Co-hosted by NED University of Engineering and Technology and Dawlance, this dynamic two-day event exemplified the power of collaboration, creativity, and forward-thinking solutions.

Undergraduate participants, organized in teams, rose to the challenge by presenting groundbreaking ideas to enhance energy efficiency, integrate smart technologies, waste reduction, and incorporate eco-friendly materials in the design of Dawlance products. The hackathon showcased a wealth of talent and ingenuity, aligned with Dawlance's commitment to building a sustainable and environmentally responsible future.

Highlights of the event included:

- Innovative solutions that pushed the boundaries of sustainability in home appliances
- Teams competing for cash prizes and the chance to collaborate with the Dawlance team to further develop their ideas
- A collective vision to inspire meaningful change and progress toward a greener, more resilient planet

The Dawlance Sustainability Hackathon was more than just a competition—it was a platform for empowering young innovators to create lasting impacts in their communities and beyond. The solutions presented and the enthusiasm displayed by the participants reaffirm the potential of the next generation to drive the transition toward a sustainable future.

We extend our heartfelt gratitude to all participants, mentors, judges and organizers for making this hackathon a resounding success. Together, we are one step closer to a better planet.

ORGANIZING COMMITTEE

Patron in Chief:
Prof. Dr. Sarosh Hashmat Lodi,
Vice Chancellor, NED University of Engineering and Technology

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Pro Vice Chancellor, NED University of Engineering and Technology

Co-Patron:
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Dean Faculty of Architecture and Sciences, NED University of Engineering and Technology

Co-Patron:
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Dean Faculty of Electrical and Computer Engineering, NED University of Engineering and Technology

Conference Chair:
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Chairman, Department of Telecommunications Engineering, NED University of Engineering and Technology

Conference Co-Chair:
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Conference Co-Chair:
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Chairman, Department of Electronic Engineering, NED University of Engineering and Technology

Conference Secretary:
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Assistant Prof., Department of Telecommunications Engineering, NED University of Engineering and Technology

Joint Secretary:
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Assistant Prof., Department of Physics, NED University of Engineering and Technology

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Dr. Sundus Ali
Asst. Prof., Department of Telecommunications Engineering

Dr. Roohi Zafar
Asst. Prof., Department of Physics
Dr. Ghulam Mustafa
Lecturer, Department of Physics
Ms. Arham Iqbal
Lecturer, Department of Electronic Engineering

KEYNOTE SPEAKER

PROF. DR. NOMAN AHMED

Dean, Faculty of Architecture & Sciences
Chairholder and Network Coordinator, UNESCO Chair for Sustainable Urban Regions
NED University of Engineering and Technology

Professor Dr Noman Ahmed currently serves as a Professor and Dean in the Faculty of Architecture and Sciences at NED University. His extensive background includes self-motivated research studies on developmental issues, particularly infrastructural planning, and management. Dr Ahmed has also worked as a consultant for international agencies, NGOs, and government organizations both in Pakistan and abroad. Among his notable achievements, Dr Ahmed has authored several recent books, including 'Water Supply in Karachi: Issues and Prospects' and 'Karachi: The Land Issue', which provide insights into urban design from the perspective of Karachi. His contributions have earned him prestigious awards, such as the 'Best Teacher Award' from the Higher Education Commission, the Dr Akhter Hameed Khan Memorial Award from the Pakistan Council of Social Sciences, and the Best Writer Award on Environment and Development from the All-Pakistan Newspaper Society. Additionally, he was honored with the Tamgha-e-Imtiaz, bestowed upon him on 23rd March 2021.Dr Ahmed's influence extends beyond academia. He holds the position of Chair Holder and Network Coordinator for the UNESCO Chair on Sustainable Urban Regions at NED University. Furthermore, he actively contributes to public discourse by writing on development issues in Pakistani newspapers.

KEYNOTE SPEAKER

PROF. DR. M. ZEESHAN SHAKIR

Professor, Wireless Communications
University of the West of Scotland (UWS),
United Kingdom

Muhammad Zeeshan Shakir is a distinguished Professor of Wireless Communication at the University of the West of Scotland. He is also the Director of the UWS Digital Connectivity and Innovation for Sustainable Futures. With over twenty years of experience, Prof. Shakir has successfully secured nearly £9 million in research funding from prestigious organizations, including Innovate UK, the ERASMUS program, the UK Government, Qatar National Research Fund, the British Council, the National Institute for Health and Care Research (NIHR), and the Scottish Government. Prof. Shakir's research focuses on advanced digital technologies, particularly 5G/6G networks, the Internet of Things (IoT), and artificial intelligence (AI). Prof. Shakir has published more than 200 research articles and made significant contributions to ten highly regarded books. He has received numerous awards for his research, including SMA award 2024 for contribution in education in Scotland, the Award of Excellence for Outstanding Knowledge Transfer Partnerships from Innovate UK in 2023 and 2018, the Herald Higher Education Award in 2023, and the SAMEE STEM Inspiring Diversity and Inclusion Award in 2022. His achievements have also been recognized with the IEEE Communications Society Fred W. Ellersick Award in 2021 and the IEEE Communications Society and China Institute of Communications Best Journal Article Award in 2019. Prof. Shakir is actively involved in the academic community, serving as a chair and organizing committee member for several conferences and technical symposiums, including IEEE flagship events such as Globecom, ICC, and WCNC. He is currently the executive chair for IEEE ICC 2026 in Glasgow and chairs the IEEE Communications Society's emerging technologies committee on backhaul/fronthaul and the Public Safety Technology Committee Informatics. In addition to his academic and professional roles, Prof. Shakir is a Fellow of the Higher Education Academy in the UK and a Senior Member of IEEE. He remains engaged with the IEEE Communications Society and is a proud member of the Royal Society of Edinburgh Young Academy of Scotland, reflecting his dedication to advancing both academia and technology.

KEYNOTE SPEAKER

DR. MUHAMMAD ALI ISMAIL

Professor and Chairman
Department of Computer and Information Systems Engineering,
NED University of Engineering and Technology

Dr. Ali Ismail received ME in Computer Systems from NED University and holds a Ph.D. in High-Performance Computing and Parallel Processing from NED University. He completed a Post Doctorate in "Automatic Design Space Exploration and Multi-Objective Optimization" from Lucian Blaga University Sibiu, Romania. He has authored 45+ research papers and book chapters, presented at international conferences, and delivers keynote speeches. He is a member of PEC, IET, IEEE, and others. He is awarded best paper honors and Research Productivity Award in 2015. He is also the in charge of the High-Performance Computing Center, NED UET and head the Exascale Open Lab as a part of national center of Data Analytics and Cloud Computing.

KEYNOTE SPEAKER

DR. SAMINA KIDWAI

Biological Oceanographer/Marine Biologist/Ecologist, Independent Consultant

Oceanographer with 30 years of research experience, 27 years at the National Institute of Oceanography, Government of Pakistan. Served the last 3 years as the Director General (CEO) of the National Institute of Oceanography, Government of Pakistan. Currently appointed as Honorary Professor, State Key Laboratory for Estuarine and Coastal Research, East China Normal University, P.R. China. Representative of Integrated Marine Biogeocchemistry and Ecosystem Research (IMBeR) in Pakistan. Technical Advisor for a project of the Teacher Resource Centre (TRC), Karachi, Pakistan for Climate Change in the school curriculum of Pakistan, a project of US Consulate, Karachi. Member of the Working Group No 9, "Skills, Knowledge and Technology for All, of the Ocean Decade Vision 2030" published by UN June 2024. National Representative in the IOCINDIO, elected member to the Executive Council Group IV of UNESCO Inter-governmental Oceanographic Commission (IOC) and member of the National Committee of SCOR (Scientific Committee on Oceanic Research). Contributor to Pakistan preparedness for international programs such as the UN SDG14, Blue Economy, UN OCEAN DECADE program 2021-2030 & IIOE-2. Coordinated two international collaborations of NIO with China. Committee member of the Regional Whale Shark Conservation in the Arabian Region Ministry of Environment and Climate Change, Qatar. More than 60 scientific publications (scientific journals/peer reviewed with impact factor, recognized, book chapters, project/technical reports, general interest articles etc.). Research interests include Biological Oceanography, (zoo)plankton ecology, bio-physical interactions and coastal deep-sea interface and its effects on plankton ecology, food-web dynamics using biomarkers, the Northwest Arabian Sea, island and deltaic ecosystems and the impact/resilience to climatic variability on marine ecosystems, Marine Protected Areas (MPAs).

KEYNOTE SPEAKER

DR. SEEMA ANSARI

Associate Professor and
Advisor to Rector
Institute of Business Management (IoBM)

Dr. Seema Ansari holds a Ph.D. in Telecommunication Engineering from the University of Malaga, Spain, and an MS-CS/Telecommunication from the University of Missouri, Kansas City, USA. Currently an Associate Professor and Advisor to the Rector since February 2022, she previously served as Associate Dean of Engineering & Sciences at IoBM. With 39 years of academic and management experience, she has contributed to prestigious institutions like Staffordshire University (UK), APIIT-Malaysia, and top universities in Pakistan. She led APIIT Karachi Campus and secured HEC recognition for collaborative degree programs. Her research focuses on Underwater Communications, IoT, IoUT, and 5G/6G networks, with contributions to JCR journals (W-Category), conferences, and book chapters published by Springer and IGI Global. She is a reviewer for international Journals.

KEYNOTE SPEAKER

SHAHID LUTFI

Director,
Exponent Engineers (Pvt) Ltd.

Mr. Shahid Lutfi is the Director of Environmental Engineering Department. Has more than 20 years of professional experience in the field of Environmental Engineering. He has received M.S. Environmental Engineering from Georgia Institute of Technology, Atlanta, USA, in September 1993. Mr. Lutfi is responsible for planning and scheduling of projects, report generation, computer-based time scheduling and planning, coordination with clients and negotiations etc.

He has conducted many environment studies and audits, Environment impact Assessment and Environmental Baseline studies. He is a member of Pakistan Engineering Council, Assessment Association, and Assessment Water Works Association.

KEYNOTE SPEAKER

ZARAK KHAN

Deputy Director, SME,
Housing & Sustainable Finance Department
State Bank of Pakistan

Mr. Zarak Khan serves as Deputy Director in SME, Housing & Sustainable Finance Department at the State Bank of Pakistan. A PhD scholar in Economics with over seven (07) years of experience in development finance, Mr. Khan specializes in green banking and overall sustainability. He has been instrumental in designing and implementing transformative policy frameworks, including the Green Banking Guidelines, the Environmental & Social Risk Management (ESRM) Framework, and the development of Pakistan's National Green Finance Taxonomy. He has collaborated extensively with leading multilateral institutions such as the World Bank, IFC, and ADB on technical assistance and capacity-building initiatives. Mr. Khan remains committed to advancing green finance and fostering sustainable economic growth.

KEYNOTE SPEAKER AND PANEL EXPERT

YASIR HUSSAIN DARYA

Director,
Climate Action Center (CAC)

Yasir Husain aka Yasir Darya is the director of the Climate Action Centre CAC. He is a Pakistani artist, activist, and futurist known for his work on building the urban and rural capacity for an equitable climate future.

He is the founder of Darya Lab, a creative think-tank focused on using culture and technology to address the climate crisis. Darya is also a co-founder of the Green Pakistan Coalition, a network of organizations advocating for environmental protection through legislation and litigation.

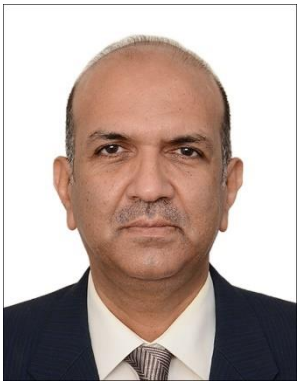
His work often explores the intersection of technology, art, and ecology. One of his notable projects is "Air Rider," an interactive art installation that allows users to experience air pollution data through a live performance.

Darya's work has been featured in exhibitions and publications worldwide, and he has received recognition for his contributions to climate activism and art. He continues to be a leading voice in the fight to prepare our society from climate damage and a driving force in promoting smart green solutions for a better future.

PANEL EXPERT

DR. MEHMOOD ALI

Associate Professor and Chairman,
Department of Environmental Engineering,
NED University of Engineering and Technology



Dr. Mehmood Ali, is an Associate Professor in the Department of Environmental Engineering, NED University of Engineering & Technology, Karachi with a background of 28 years career of industry and academia progressive experience in conducting, supervising and planning research on biofuels and bioenergy from vegetable oil seeds/ agricultural waste and microalgal biomass. He completed his BEng and MEng in Mechanical Engineering and Environmental Engineering from NED University, Karachi, Pakistan in 1995 and 2001 respectively. Then finished his PhD in Mechanical Engineering from the University of Glasgow, Scotland, UK and published 40 research articles in reputed journals/ conferences and presented research findings at different local and international forums. His research experience includes biofuels (environmentally friendly fuels) production, bioenergy generation from agricultural residues, carbon capture technologies (microalgae cultivation), Solar drying systems, Energy conservation and Sustainable energy technologies.

PANEL EXPERT

ENGR. ABUBAKAR ISMAIL

Head of Energy and Sustainability,
Amreli Steels

Engineer Abubakar Ismail is a seasoned professional with a wealth of experience in the energy sector. Having served in diverse roles across organizations ranging from utilities like NTDC and KE to multinational giants such as Siemens and Alstom, he brings a breadth of knowledge to the table. Currently, he spearheads the Energy & Sustainability Division at Amreli Steels Limited, showcasing a deep dedication to driving sustainable initiatives within the industry. Passionate about energy, sustainability, and emerging technologies, he is always eager to share his expertise and contribute to the advancement of knowledge in these fields.

PANEL EXPERT

AMBREENA AHMED

Director, Teachers' Resources Center

Ambreena Ahmed is the Director of Teachers' Resource Centre (TRC), a pioneering education institution in Pakistan working on quality reforms, especially teachers' development, since 1986. She is a versatile professional working for the last 23 years who has designed and led diverse projects in both public and private sectors for education communities across Pakistan. She has recently curated a first of its kind climate change education initiative called CANDLE and has led the development and launch of Pakistan's Introductory Curriculum on Climate Change Education (grades 1 to 10) along with an interactive teachers' toolkit for introducing student led climate change pedagogy in schools.

She firmly believes that teachers have the power to transform education and is continually working to further strengthen TRC as an empowering platform for teachers' professional development offering both locally and internationally accredited qualifications.

Ambreena has a deep admiration for people who are compassionate and intelligent. She believes kindness alone can solve most of humanity's problems. She also made it to the Ponds' 100 Miracle Women list of 2015.

PANEL EXPERT

ZEHRA ANEEK

Director, Sustainability Consulting,
Ernst & Young Pakistan

A leader focused on making transformational impact in the Sustainability and Energy space. Zehra Aneek has 20+ years of cross-functional sectorial experience across Sustainability, cleantech, Climate Change, Corporate Governance, Transformational Strategy and Communications.

Currently, she leads the Sustainability and Climate Change unit at EY Pakistan. Previously she was Director ESG and Sustainability at K-Electric Limited. She has also been associated with British American Tobacco, KFC Pakistan and Chevron at various senior Sustainability and Communications roles. She is Member, of the International Society for Sustainability Professionals (ISSP)-USA and Member Energy Expert Platform, Global Women Network in Energy Transition (GWNET)-Associate member of the Institute of Environmental Management and Assessment (IEMA) and Member We Power-World bank. She is a Chairperson of the 'Energy Circle', LEAN-IN Pakistan. Mentor for Global Climate Launchpad, Mentor Women in Social Enterprise and Girl2023. She is member board of trustee at Concern for Children and also sits on the advisory board of ROSHNI, a not for profit working on children safety and welfare. She is a frequent speaker and contributor at various Climate, Energy, ESG and Diversity related national and global forums. She also sits on the jury of various Global Environmental and Social initiatives.

PANEL EXPERT

ABBAS ALI

Partner, Consulting Services
EY Ford Rhodes

Mr. Abbas Ali is a Partner in Consulting Services at EY Ford Rhodes and leads the Government-Public Sector, Financial Services and Sustainability advisory services. With over 20 years of experience working in multiple domains including transformation, institutional reform, landscape / ecosystem assessments, and sectoral studies. As a Consulting leader, Abbas has led multiple large-scale deliveries for some of the largest Development Agencies, and Development Finance Institutions, including project assessments for financing.

PANEL EXPERT

MUSTAFA DIWAN

Director of Operations and Marketing,
Gatron (Industries) Ltd.

Gatron is the largest producer of Polyester Filament Yarn in Pakistan. While Novatex has consistently ranked among the country's largest non textile exporter. Both companies are part of the larger G&T group which includes companies such as Bonanza, Mustaqim and Krystalite among other others. Mustafa has a bachelor's degree in business administration from the University of Southern California. In addition to his work within the G&T group, Mustafa has also contributed to the Lasbela Chamber of Commerce and Industry as a member of its Executive Committee. He is also on the Board of Directors of the Employers Federation of Pakistan. His experience spans across multiple sectors, showcasing his engagement in both corporate operations and industry affairs.

PANEL EXPERT

MUNEEBA HAROON

Chief Operating Officer,
The Green Ark

Muneeba Haroon is a dynamic business development professional with a proven track record in strategic planning, operational management, and sustainability initiatives. As the Chief Operating Officer at TGA Sustainability Pvt Ltd, founded in 2022, she plays a pivotal role in driving the company's mission to create a value chain in the circular economy. TGA specializes in providing recycling solutions for post-industrial and post-consumer waste, producing recycled polymer resins, and innovating products from non-recycled waste to reduce landfill impact. Muneeba's leadership ensures operational efficiency, business expansion, and strong stakeholder partnerships, aligning with TGA's sustainability goals. Her ability to navigate complex challenges and implement effective solutions has been instrumental in positioning TGA as a leader in sustainable waste management.

PANEL EXPERT

ATTIYAH INAAM

Head of Corporate Communication, Sustainability & PR
EBM

Attiyah is the Head of Corporate Communications, sustainability & PR at EBM. With over 19 years of experience in corporate communication, sustainability, and public relations. She leads sustainability initiatives and manages executive-level communication and reputation management. She also served as Manager of Communications & Resource Development at a non-profit from January 2011 to May 2013. Earlier roles include ABM & Senior Revenue Management Analyst at Pakistan International Airlines and Assistant Manager at United Bank Limited. Attiyah is passionate about change and She works with diverse groups to solve problems, seeing them as potential opportunities. She loves telling stories that sell brands and their legacy, bringing people together for common causes, and cultivating relationships every day.

PANEL EXPERT

DR. TEHMINA AYUB

Professor

Department of Civil Engineering

NED University of Engineering and Technology

Dr. Tehmina Ayub is a distinguished Professor in the Department of Civil Engineering at NED University of Engineering & Technology in Karachi, Pakistan. She holds a PhD from Universiti Teknologi PETRONAS, Malaysia. Her research specializes in High-Performance Fiber Reinforced Concrete beams and sustainable materials, with a focus on circularity. Dr. Ayub has served in various esteemed academic and engineering roles, contributing to numerous projects, including structural design and conservation. She has secured several grants for research on sustainable materials and concrete durability. Her work includes studies on the use of recycled concrete aggregates and the development of eco-friendly cement blends. Dr. Ayub's commitment to sustainability and circularity in construction materials underscores her contributions to the field, making her a valuable asset to both academia and industry.

PANEL EXPERT

MUMTAZ HUSSAIN

Chair,
IEEE Young Professionals

Mumtaz Hussain, a Computer Science graduate from SMI University, Karachi, Pakistan. With nearly seven years of diverse professional experience, he is actively engaged in academic research and has authored six publications in national and international journals, conferences, and a book. His research interests span Cybercrime, Cybersecurity, Social Engineering, Data Privacy, Artificial Intelligence & Ethics, and Artificial Intelligence in Cybercrime (AICC). An IEEE member since 2018, Mumtaz has been the Chair of IEEE Young Professionals (YP) Karachi Section since 2022, where he has driven collaborations and secured findings to support various educational initiatives. Additionally, he is the founder of The Human Tales (THT), a non-profit social initiative focused on promoting a peaceful and inclusive society by aligning with the United Nations' 16th Sustainable Development Goal, which emphasizes peace, justice, and strong institutions.

PROGRAM SCHEDULE

Day 1: Thursday, January 16, 2025		
9:30 - 11:00	**Inaugural Session** Venue: Ashraf Habib Ullah A/V Hall *- Recitation of the Holy Quran & National Anthem* *Welcome address by Conference Co-Chair, Dr. Irfan Ahmed* *- Keynote speech on Climate and Sustainability* *-Speeches by Conference Sponsors* *- Speeches by Chief Guest, Guest of Honour and University Leadership* *- Vote of Thanks by Conference Co-Chair, Dr. Ghous Bakhsh Narejo*	
11:00 – 11:30	**Tea and Networking**	
11:30 - 01:00	**Technical Session 1** *- EY Knowledge Session on Advancing the Circular Economy in Pakistan* Venue: Mechanical A/V Hall	
01:00 - 02:30	**Lunch and Prayer Break**	
02:30 - 05:00	**Technical Session 2** ***Stakeholder Engagement for Climate Action*** *-3 Keynote Speeches* *- Panel Discussion on stakeholder engagement* Venue: Mechanical A/V Hall	**Technical Session 3** ***Agriculture and Water Management*** *-2 Keynote Speeches* *-5 Abstract Presentations* Venue: STEM Centre or Smart Classroom
Day 2: Friday, January 17, 2025		
10:00 - 12:30	**Technical Session 4** ***Green Economy and Sustainability*** *-1 Keynote Speech* *-6 Abstract Presentations* Venue: Smart Classroom	**Technical Session 5** ***Emerging Solutions for Climate Action*** *-2 Keynote Speeches* *-5 Abstract Presentations* Venue: Mechanical A/V Hall
01:00 - 02:30	**Lunch and Prayer Break**	
02:45 - 05:00	**Closing Session** Venue: Ashraf Habib Ullah A/V Hall - *Recitation of the Holy Quran & National Anthem* - *Keynote address by Co-Patron, Prof. Dr. Saad Ahmed Qazi, Dean ECE, NEDUET on NED University Initiatives on Climate Change, Sustainability and Carbon Neutrality* - *Address by Co-Patron, Prof. Dr. Noman Ahmed, Dean ASC, NEDUET* - *Address by Dawlance Management and Announcement of Hackathon winners* - *Address by NEDUET Management* - *Conference Highlights and Recommendations by Conference Chair - Dr. Muhammad Imran Aslam* - *Vote of Thanks by Conference Secretary*	
05:00 – 05:30	**Tea and Networking**	

LIST OF ABSTRACTS

Development of a LoRaWAN-based mobile IoT system for real-time Climate Monitoring

Sundus Ali[1], Tanzila[1*], Syeda Kashaf Kulsoom[1], Ghulam Fiza[1], Irfan Ahmed[2], Muhammad Imran Aslam[1]

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Climate change poses a significant threat to life on land, impacting ecosystems, agriculture, and biodiversity. One of the critical challenges is the real-time monitoring of localized environmental parameters to assess and potentially mitigate these effects. In this work, we present the design and development of an Internet of Things (IoT)-based system aimed at monitoring key climate parameters such as temperature, humidity, and carbon dioxide (CO_2) levels. These parameters provide crucial insights into local climate conditions, enabling timely intervention and more effective environmental management. Our developed system leverages Long Range Wide Area Network (LoRaWAN) communication technology, which is particularly suited for remote sensing applications due to its low power consumption and long-range capabilities. LoRaWAN enables the deployment of sensor nodes in remote or difficult-to-access locations, where traditional communication technologies may be unreliable or costly. The network's low power requirements result in extended battery life, making it an efficient solution for long-term climate monitoring. The data collected from these sensor nodes is transmitted to a central server through a LoRaWAN gateway, via a reliable, long-range wireless connection, ensuring consistent monitoring without the need for continuous maintenance or human intervention. This LoRaWAN-based IoT system provides mobility, allowing for the expansion of sensor networks across diverse terrains. The architecture not only ensures a robust data collection mechanism but also offers scalable solutions for increasing the number of monitored parameters as well as end devices. By providing continuous, real-time data, the system enables a more proactive approach to climate monitoring to timely develop mitigation strategies. we also plan to expand the developed system by integrating additional sensors, for instance particulate matter sensor, carbon monoxide (CO) sensor, etc., to monitor a broader array of climate factors. We also aim to increase the spatial coverage of LoRaWAN gateways to monitor larger areas, further enhancing the system's scalability and operation. This scalable system holds potential for a wide range of applications, including precision agriculture, precision air quality monitoring, environmental conservation, and disaster monitoring and management, contributing to the global effort to protect life on land and combat climate change.

Keywords: Internet of Things, LoRaWAN, climate monitoring, air quality, remote sensing

Enhancing IoT Plant Monitoring with Edge Computing for Real-Time Agricultural Decision-Making

Muhammad Haashir Absar [1*] , Hafsa Zaman [1],

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As IoT technology reshapes modern agriculture, real-time monitoring of vital plant health factors has become increasingly accessible. However, traditional cloud-based processing in these systems can lead to delays and reliability issues, especially in rural or remote areas with limited internet connectivity. This study introduces an enhanced IoT plant monitoring system that integrates edge computing, allowing data from soil moisture, temperature, humidity, and light sensors to be processed locally, directly on the IoT devices. By analyzing data at the source, this approach reduces dependence on constant cloud connectivity and enables faster, on-the-spot decision- making. A lightweight machine learning algorithm deployed on microcontrollers enables rapid classification of environmental conditions, triggering immediate responses to changing plant needs without waiting for cloud feedback. Field tests demonstrate that this edge computing solution can cut data transmission delays by up to 70%, making it particularly useful in remote agricultural settings. This novel approach addresses a key limitation of existing IoT-based monitoring by significantly improving speed and reliability, helping farmers make timely interventions and optimize resources for healthier, more resilient crops.

Keywords: Edge Computing, Internet of Things, Real-Time Data Analytics, Remote Sensing Technology, Sustainable Agriculture

IoT Based Refrigerator Monitoring System

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In the ice cream industry, maintaining optimal refrigeration is critical to preventing spoilage, ensuring quality, and reducing operational costs. However, challenges such as compressor failure, uneven cooling, inefficient product distribution, and unauthorized refrigerator movement persist, leading to significant financial losses and compromised product integrity. This project introduces an IoT-based refrigerator monitoring system tailored to the ice cream sector, integrating advanced sensors for real-time data collection and analysis. The DS18B20 temperature sensor, with an accuracy of ±0.5°C within a range of -10°C to +85°C, ensures precise monitoring of internal freezer conditions. The JSN SR-04T ultrasonic sensor operates effectively at temperatures from 0°C to -20°C, providing volumetric accuracy of 95% to optimize storage space and enable efficient product placement. The SCT013 current sensor, accurate within 1-2%, identifies anomalies in compressor behavior, such as detecting Locked Rotor Ampere, allowing timely diagnosis of performance issues. Additionally, the u-blox NEO-M8N GPS module offers precise location tracking with an accuracy of 0.6 to 1 meter, enabling geofencing to prevent unauthorized movement. Sensor data is transmitted to Firebase, a secure cloud platform, where it is processed and displayed on a user-friendly mobile app. This app provides real-time insights, predictive maintenance alerts, and analytics to optimize refrigeration operations. Controlled testing demonstrated a 15% improvement in shelf-life consistency through uniform cooling, a 20% reduction in energy waste by addressing inefficiencies, and a 40% decrease in unplanned downtime due to predictive maintenance. The system ensures optimal storage conditions and enhances operational efficiency, reducing spoilage and ensuring consistent product quality. This comprehensive, scalable solution aligns with the operational needs of the ice cream industry. By leveraging real-time monitoring, intelligent analytics, and proactive maintenance, the system minimizes losses, optimizes resources, and promotes sustainability. It sets a new benchmark for proactive refrigeration management, addressing industry-specific challenges and improving efficiency across the cold storage sector.

Keywords: Refrigeration Monitoring, Asset Protection, Real-time Analytics, Proactive Maintenance, Supply Chain Management

Electricity Generation Through Water Pipes in Textile Factories

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It is well said, and I quote that a penny saved is a penny earned, the same is also true for the energy sector where we need to optimize the systems to get the maximum output from the existing. The world is entering an era that is extremely power-hungry, so all efforts will be required to extract maximum power by enhancing the efficiency of each system, as well as by collecting all possible energy from different sources. In our country, which is in desperate need of cheap energy, it is also significant that we generate electricity from all possible resources. Pakistan possesses huge textile- orientated industry, which uses extensive amount of water for its various operations. In this research, we are proposing a novel method to generate electricity from the movement of water in textile factories specifically from the water falling down through the vertical pipes. In the scope fo the research, energy potential has been estimated and hardware turbine for that can generate electricity in a small-scale industrial set-up has been proposed. Along the vertical water pipe, we will install a turbine and a generator. As the water flows naturally through the pipe, it will hit the blades of the turbine, causing it to spin. This rotational motion will drive the generator, converting the kinetic energy of the flowing water into usable electrical energy. It is estimated that approximately 10 KW energy per day can be acquired in a medium scale textile factory.

Keywords: Energy, Turbine, Generator, Renewable, Optimization, Pipe

Green Rooftops using Hydroponics and Fresh Water

Dr. Atif Mustafa[1], Hassan Memon[2*], Shazan Ahmed Siyal[2], Muqadas Ali Qadri[2], Mehtab Ali[2]

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Rapid urbanization and population growth have intensified challenges related to food security, water conservation, and urban climate management. Conventional agriculture's reliance on extensive water and land resources exacerbates these issues. This research addresses these challenges through rooftop hydroponic systems, which offer sustainable solutions by reducing water usage, optimizing space, and lowering carbon footprints. Conducted on the rooftop of the Urban Engineering Department at NED University of Engineering and Technology, Karachi, Pakistan, this study investigates the performance of hydroponic systems—Nutrient Film Technique (NFT) and Dutch Bucket System (DBS)—and compares their efficiency with conventional agricultural methods. The methodology involved setting up NFT and DBS hydroponic systems under controlled greenhouse conditions. Water recirculation techniques were employed to conserve resources, while parameters such as temperature, humidity, pH, and Total Dissolved Solids (TDS) were monitored daily. Crops like strawberries, lettuce, and soybean were grown using nutrient-rich solutions, and their growth performance was compared to plants cultivated through conventional soil-based methods. Results demonstrated that hydroponic systems significantly reduced water consumption, with up to 33% less water usage compared to conventional methods, while maintaining optimal TDS and pH levels. Space utilization in hydroponic systems was notably efficient, accommodating 60 strawberry plants in just 30 square feet compared to 48 square feet required for conventional setups. Although conventional systems yielded higher plant output in some cases, hydroponics provided better control over environmental factors, enabling year-round production and improved crop quality. The study concludes that rooftop hydroponics is a viable solution for urban agriculture, addressing food security and sustainability concerns. By reducing water usage, optimizing spatial efficiency, and mitigating urban heat island effects, hydroponics presents an innovative approach to sustainable food production. Further research is recommended to enhance crop yield, improve cost efficiency, and adapt these systems to diverse climatic conditions for broader urban applications.

Keywords: Climate adaptation, Urban farming, Hydroponics, Water conservation, Urban sustainability

Environmental Sustainability in Pakistan: The Interplay of Governance, Green Economy, and Environmental Management Systems

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The Green economy emphasizes the integration of economic growth with environmental sustainability, particularly in response to climate change and resource depletion. This study investigates the interplay between governance, the adoption of Environmental Management Systems (EMS) like ISO 14001, and green economy initiatives in Pakistan. It aims to evaluate the effectiveness of ISO 14001 in enhancing environmental performance and to analyze how governance indicators—such as political stability and regulatory quality—affect these initiatives. Utilizing a quantitative approach, the research will analyze data from 2000 to 2022, employing Grey Relational Analysis to elucidate the relationships among these variables. The findings are expected to inform policy recommendations that strengthen governance frameworks, thereby facilitating a transition to a sustainable economy that benefits both the environment and economic growth in Pakistan.

Keywords: Green Economy, Environmental Sustainability, Good Governance, ISO 14001, Environmental Management Systems (EMS)

Evaluating the Water Quality Index (WQI) of Jamshoro and Hyderabad Water Samples

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Water quality index (WQI) is a significant and distinctive evaluation to show the general condition of the water quality. To integrate the microbiological investigation for improving water safety of selected areas. Tap water can contribute to water pollution through contaminated sources or distribution systems. The aim of this study was to determine the quality of drinking and raw water in the area of Jamshoro and Hyderabad. Samples were taken from five different points and analyzed based on the standard methods for the following parameters: temperature, pH, electrical conductivity (EC), turbidity, dissolved oxygen (DO), salinity, and fecal coliform. The concentrations of these parameters were compared with standard values of World Health Organization (WHO). Turbidity levels in sample S3 were measured at 5.66 NTU, exceeding the WHO limit of 5 NTU, which raises concerns about potential contaminants. The assessment of water quality was made using the water quality index (WQI) of the weighted average water quality index (WAWQI). The results show that, the calculated value of WAWQI indicates that the physical parameters of water quality in the areas are "excellent," but the elevated turbidity and the presence of fecal coliform are the main problems in quality. Fecal coliform findings indicated that sample ID S1 had 1 CFU/100 mL of contamination, S2 had 5 CFU/100 mL, S3 had TNTC, and S5 had 12 CFU/100 mL. The coliform count was seen to be higher in samples. The mean value of WHO has specified a zero-limit contamination for coliform. The health of the public can be seriously affected by threat posed by bacteriological contamination in the form of a coliform organism. However, regular monitoring is important to ensure water quality remains within safe limits.

Keywords: Water quality index, Parameters, Assessment, Fecal coliform, Water safety

AgriSense: Smart Solutions for Precision Farming, Sustainability and Resource Efficiency

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In modern agriculture, effective resource management is a key challenge for ensuring sustainable crop production and food security, with estimates suggesting that precision agriculture techniques could reduce input costs by up to 30%. AgriSense addresses this issue by offering a real-time IoT- based system designed to help farmers monitor and manage soil and crops based on environmental conditions. The system integrates a network of sensors, including soil moisture, humidity, NPK nutrient, and water level sensors, all connected to a Wi-Fi-enabled microcontroller. Data collected on soil moisture, nutrient levels, temperature, humidity, and water levels is sent to a cloud server using the ESP32 Wi-Fi controller. For data transmission in areas without stable internet access, LoRaWAN technology is utilized, achieving a tested range of over 3 km in urban environments, with an expected reach of 10 km. This ensures broad applicability and reliable communication even in remote locations. AgriSense empowers farmers to make informed decisions about irrigation and fertilization, improving resource optimization and crop yields. Initial testing has successfully demonstrated real-time data storage in a database, enabling seamless visualization on the mobile application dashboard. Additionally, the system's recommendation feature has been rigorously tested under diverse conditions, consistently suggesting suitable crops, which not only enhances crop yields and output but also has the potential to boost farmers' income and positively impact national agricultural exports. The novelty of AgriSense lies in its ability to provide real- time, actionable insights through advanced data analytics and machine learning techniques. Farmers receive real-time notifications and recommendations via a multilingual mobile application designed for ease of use, requiring minimal training. This ensures that farmers of all technical skill levels can benefit from the system. By helping farmers make data-driven decisions, AgriSense enhances productivity, reduces costs, and improves crop quality by providing timely, accurate data. It addresses a critical need in modern agriculture, contributing to more sustainable and efficient farming practices, ultimately leading to a more productive and environmentally responsible future.

Keywords: Machine Learning, Precision Agriculture, Internet of things (IoT), Sustainable System, Data Analytics

Technological Advancements for Climate Action: Leveraging Geo AI and Remote Sensing to Address Climate and Environmental Challenges in Sana'a, Yemen

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This research addresses critical climate and environmental challenges in Sana'a, Yemen, using advanced geographic technologies, namely Geospatial Artificial Intelligence (GeoAI) and remote sensing. With rising air pollution, declining vegetation cover, and significant public health impacts, there is a pressing need for precise, data-driven solutions to support climate action in urban areas. The research identifies and quantifies pollution hotspots, assesses vegetation loss, and analyzes the spatial distribution of air quality and environmental health risks across Sana'a, aiming to provide actionable insights for sustainable urban management. The methodology integrates remote sensing and Geographic Information Systems (GIS) to create spatial datasets and maps that visualize pollution levels and vegetation density. Leveraging GeoAI techniques, we analyze these datasets to identify trends, correlations, and patterns associated with climate change, urbanization, and pollution effects on the urban ecosystem and population health. High-resolution satellite imagery, paired with air quality and vegetation indices, supports a comprehensive environmental assessment, enabling precise tracking of changes over time. Data preprocessing, model training, and validation are performed to ensure accuracy and reliability in the analysis, addressing existing limitations in data access and technical infrastructure in the region. Preliminary Results reveal significant correlations between pollution concentrations and areas of reduced vegetation, underscoring the ecological impact of urbanization on vegetation health and air quality. These findings suggest targeted zones where interventions, such as reforestation or pollution control measures, could have the most substantial impact. The study also highlights the health implications of sustained exposure to pollution in densely populated areas, suggesting a need for integrated environmental and public health strategies in urban planning. The analysis yielded promising results, demonstrating that combining GeoAI and remote sensing can effectively map pollution dynamics and environmental vulnerabilities in complex urban settings. For example, predictive models successfully identified potential pollution hotspots with over 85% accuracy, guiding resource allocation for environmental restoration. Additionally, vegetation monitoring revealed a 30% decline in green cover over the past decade, emphasizing the urgent need for conservation efforts. The research framework developed offers a scalable and transferable model for addressing similar environmental challenges in other resource-constrained cities worldwide. By linking environmental monitoring with public health data, this study paves the way for innovative, tech-driven policy-making that supports climate resilience and sustainable urban development.

Keywords: GeoAI, remote sensing, air pollution, vegetation cover, Sana'a, Yemen

Exploring the Spatial Patterns and Temporal Trends of Phytoplankton Variability in the Arabian Sea by Ocean Remote Sensing During 2011 to 2020

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Phytoplankton, microscopic plants pivotal in food production, oxygen generation, and climate regulation, play a critical role in marine and environmental systems. This study emphasizes the use of remote sensing technology to analyze and identify seasonal and intra-annual variations in phytoplankton dynamics, specifically through Marine Chlorophyll-a (Chl-a) products. Utilizing MODIS time series images from 2011 to 2020, we employed standard MODIS methodologies to assess Chl-a as a proxy for phytoplankton presence. Our analysis focused on the Arabian Sea and the coastal waters of Pakistan, India, Iran, Oman, Yemen, and Somalia. Findings reveal significant spatiotemporal variability in Chl-a concentrations, with elevated levels observed along coastal areas, particularly in the northeastern and northwestern regions. Chl-a values ranged from 45.41 to 98.65 mg/m³, with two annual blooms identified: one in January- March and another in September-October. Notably, peak Chl-a concentrations were recorded in 2016 and 2017. The highest concentrations were found along the coastal belts of India, Pakistan, Iran, and Oman, decreasing with increasing distance from the shore.
Contributing factors to these variations include monsoon rainfall, temperature, seawater turbidity, and wind direction. The study highlights the utility of free satellite-based products for advancing research in phyto-geography, marine biology, and environmental science, offering valuable insights into phytoplankton dynamics and their environmental implications.

Keywords: Phytoplankton, Climate, Chlorophyll, Marine and monsoon

Green Supply Chain Practices in Steel Industries of Pakistan

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The steel industry is a critical sector in Pakistan's economy but significantly contributes to environmental pollution. The research investigates the adoption and effectiveness of green supply chain practices in Pakistan's steel industry, aiming to identify key factors and barriers to implementation and explore opportunities for maximizing financial revenue by reducing costs. A quantitative survey was conducted with professionals working in the steel industry and the data responses were analyzed accordingly. The findings reveal that adopting international environmental management systems frameworks such as ISO14001, investing in renewable energy technologies, upgrading steel manufacturing technologies, adopting pollution prevention innovations, warehouse upgradation and using alternative fuel logistics fleets can lead to significant cost savings and can reduced environmental impact. It also required greater collaboration through supplier relationship management which is essential for these practices. However, challenges include high initial investment costs exacerbated by economic and political instability in Pakistan along with the other challenges such as limited availability of the environmental compliant supplier in market which are the major barrier for the steel industry of Pakistan. Further the research concludes that implementing green supply chain practices can significantly reduce environmental impact, optimize resource use, and lower energy consumption, thereby benefiting both costs and the environment in steel industry of Pakistan.

Keywords: Green Supply Chain Practices, Green Manufacturing Technologies, Renewable Energy Technologies, Environmental Management Systems, Circular Economy

Thar Coal Fly Ash as an Environmental Friendly Material in Construction: Opportunities and Challenges

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Coal fly ash (CFA) is a by-product of coal combustion and can offer significant environmental and economic benefits when utilized in construction. This study explores the opportunities and challenges of using Thar Coal Fly Ash (Thar CFA) as a sustainable building material. The benefits of CFA include reduced greenhouse gas emissions, waste utilization, conservation of natural resources, improved durability, increased strength, and cost-effectiveness. Applications include concrete production, bricks manufacturing , road construction, and geo-polymer concrete. However, challenges persist, such as standardization, quality control, scalability, public perception and regulatory hurdles as well as the technical, economic, and social challenges. Addressing these barriers can unlock potential of the Thar CFA that can contribute to sustainable infrastructure development duly aligned with the sustainable developments goals (SDGs) prescribed by the United Nations particularly related to the to good health and well-being; industry, innovation, and infrastructure; and climate actions. By embracing the Thar CFA as an environmentally friendly material, the construction industry can reduce its ecological footprint while promoting sustainable growth.

Keywords: Coal Fly Ash, Sustainable Construction, Environmental Benefits, Construction Benefits, Thar Coal, Green Building Materials

A Data Mining Approach to Weather Prediction in Pakistan Using Machine Learning Models

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Predicting rainfall remains a challenging task due to the complex, nonlinear, and highly variable nature of climate and precipitation patterns, which exhibit both temporal and spatial variations. Given the increasing frequency of rain-induced floods, accurate weather forecasting is crucial for effective water resource management, agricultural planning, and disaster preparedness. This study explores rainfall prediction using machine learning (ML) techniques such as Random Forest (RF), Logistic Regression (LR), Support Vector Machine (SVM), AdaBoost, Gradient Boosting, K-Nearest Neighbors (KNN), Artificial Neural Networks (ANN), and Naïve Bayes(NB) to enhance prediction reliability. The dataset, collected from the "Visual Crossing" website, spans the years 2011 to 2023 and includes 4,778 observations and 33 features of historical meteorological data from Karachi, Pakistan. Key factors such as temperature, humidity, wind speed, and air pressure were preprocessed through data transformation, cleansing, and feature selection. The dataset was divided into training and testing subsets, and 5-fold cross-validation was used for model validation. Model performance was assessed using metrics like precision, recall, accuracy, and ROC curves. Among the tested models, Random Forest achieved the highest accuracy with a precision of 99%, while Naïve Bayes tended to overfit the data. SVM and Logistic Regression showed moderate accuracy due to challenges with nonlinear data, while Gradient Boosting and AdaBoost displayed robust accuracy and balanced precision, effectively mitigating over fitting. The results demonstrate the ability of machine learning models to capture complex patterns in the data, highlighting the potential of data-driven approaches to mitigate the impacts of climate variability and contribute to informed decision-making for sustainable environmental management.

Keywords: Data mining, Machine learning, Classification, Rainfall, supervised learning, metrological

An NB-IoT Enabled Monitoring System for Industrial Environmental Health and Safety

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Rapid urbanization along with industrial growth in Pakistan has severely impacted the environment and public health, particularly in cities like Karachi and Lahore, where factories emit harmful gases and pollutants. Residents and workers near industrial zones face increased risks of respiratory illnesses, skin diseases, and cancer. Untreated wastewater is frequently discharged into the sea, damaging marine life. Ineffective environmental monitoring and weak regulatory enforcement further exacerbate this issue. Therefore, there is strong need to develop an efficient environmental monitoring systems to monitor and potentially regulate the environmental degradation.

In order to address the issue, we aim to design, and develop an environmental monitoring system to monitor hazardous environmental parameters in industrial settings. We are incorporating narrowband Internet of Things (NB-IoT), a low-power wide-area network (LP-WAN) technology, to provide connectivity to NB-IoT devices through narrowband channels in the existing cellular network infrastructure. The proposed system focuses on detecting and assessing environmental hazards, enabling real-time monitoring of critical air and water quality parameters. Key air pollutants include Carbon Monoxide (CO), Carbon Dioxide (CO_2), Particulate Matter (PM), Ammonia (NH_3), and Volatile Organic Compounds (VOCs), which can exacerbate respiratory and cardiovascular diseases. For water quality, Total Dissolved Solids (TDS) and pH levels in industrial discharge are monitored to provide critical insights into water contaminants before release into the sea.

This centralized approach enables authorities to oversee multiple industrial sites from a single location, ensuring immediate detection of pollution spikes. The solution offers long-range, energy-efficient oversight of temperature, humidity, and various environmental parameters, delivering a holistic view of industrial hazards. By aligning with Industry 4.0 principles, the proposed system represents a significant advancement in industrial environmental monitoring. The integration of NB-IoT technology facilitates smart, real-time hazard detection —from high temperatures to harmful emissions—the system enhances safety and decision-making in industrial operations.

Keywords: Narrowband Internet of Things (NB-IoT), Low-Power Wide-Area Network (LP-WAN), Environmental Monitoring, Health risk, Industry 4.0

Climate change in Pakistan: Challenges, Impacts and the Way forward

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One of the most important global issues is Climate change. It is impacting ecosystems, human health, and the economy. Global warming is leading to rising temperatures which in turn is culminating into changing precipitation patterns, and increased frequency of extreme weather events are posing significant challenges to the country's environment, economy, and human well-being. I have attempted to explore the challenges, impacts, and the way forward for addressing climate change in Pakistan. The challenges associated with climate change include geographic vulnerability, economic impacts, and lack of public awareness. Climate change is impacting global warming, bringing changes in precipitation patterns, declining water table, low agricultural yields and human health related problems.

Keywords: Climate Change, Global warming, Human Health, Challenges, Public awareness

Innovative Solutions for Climate Action: Tackling Over-Packaging and Empowering Communities Through Olive Cultivation

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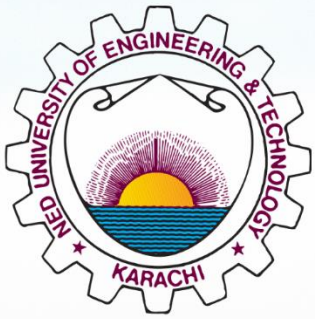
The climate crisis demands innovative and collaborative solutions to ensure a sustainable future. This presentation highlights two critical approaches to tackling environmental challenges: addressing excessive packaging for small products and empowering communities through sustainable olive cultivation. Excessive packaging contributes significantly to environmental degradation, increasing waste, pollution, and pressure on waste management systems. The corporate sector plays a pivotal role in combating this issue by adopting sustainable practices. Integrating Green Ratings into financial assessments can incentivize corporations to minimize environmental impact, aligning their operations with global sustainability goals. These ratings, alongside traditional credit assessments, would create a financial framework that rewards eco-conscious businesses, fostering a green economy.

The presentation explores the transformative potential of olive cultivation as a sustainable solution for rural communities. By promoting olive farming, we can combat desertification, support environmental restoration, and create economic opportunities for underserved populations. These initiatives not only address pressing environmental issues but also align with the principles of green financing, ensuring long-term social, economic, and environmental resilience.

With hope and determination, this presentation calls on stakeholders—including financial institutions, corporations, and communities—to join hands and take decisive steps toward meaningful climate action. Together, we can drive impactful change and build a future where economic growth and environmental sustainability go hand in hand.

Keywords: Climate Action, Sustainability, Green Financing, Olive Cultivation, Corporate Responsibility



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