

SCINERGY

RESEARCH AND INNOVATION NEWS BULLETIN

Building a Sustainable Future:
NUST Introduces Rainwater
Harvesting Wells



At NUST, rain is no longer seen as a fleeting weather phenomenon; it is increasingly being transformed into underground water capital through a host of rainwater harvesting wells. Thoughtfully constructed across the Islamabad campus, the silent network of engineered water recharge system is leveraging rainfall into a dependable reservoir that will have far-reaching dividends for the NUST community and beyond.

Under the visionary leadership of Rector NUST Dr Muhammad Zahid Latif, the construction of six rainwater harvesting wells is latest of a series of sustainability undertakings at NUST. Guided by his vision and embedded within the University’s broader sustainability agenda, the system is designed to capture, filter and return rainwater to the

underground aquifer instead of allowing it to be lost as surface runoff.

Led by the School of Civil and Environmental Engineering (SCEE), with technical expertise from the NUST Institute of Civil Engineering (NICE), the initiative addresses NUST’s growing reliance on groundwater and the increasing pressure on water resources caused by campus expansion and declining

campus’s natural northwest to southeast slope enables rainwater to flow by gravity towards designated recharge points, enhancing efficiency and reducing energy requirements.

Each recharge well features a perforated inner lining that provides structural stability while allowing water to percolate into the surrounding soil. Graded filter media remove suspended particles and reduce

“ Once fully operational, the Rainwater Harvesting Wells are expected to recharge approximately 41 million gallons of rainwater annually

groundwater levels.

Following a comprehensive assessment of campus topography and hydrology, suitable locations for recharge wells were identified. The

silt entry, ensuring cleaner water reaches deeper soil layers.

The filtered rainwater is then directed into boreholes up to 200 feet deep, equipped with perforated pipes or well screens

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where required, to enhance aquifer recharge. This integrated system maximises groundwater replenishment, reduces surface runoff, and supports the long-term sustainability of NUST’s water resources.

Beyond aquifer recharge, the initiative reduces surface runoff, mitigates waterlogging and localised flooding, and eases pressure on drainage infrastructure. It also serves as a living laboratory for students and researchers, showcasing the practical application of sustainable engineering while reinforcing NUST’s commitment to environmental stewardship and resource conservation.

NUST welcomes its new Pro-Rector Planning & Resources

National University of Sciences & Technology (NUST) welcomed Maj Gen (Retd) Muhammad Ali Khan, as its new Pro-Rector Planning & Resources (P&R) on June 4, 2026. A graduate of Command & Staff College, Quetta, and National Defence University, Islamabad, the General’s illustrious career spanned operational command, instructional appointments and academic leadership. As part of his extensive experience in resource management, institutional planning and higher education, particularly in some of the most emerging fields, the General served as the Commandant of NUST Military College of Signals (MCS), and also remained on the faculty of Pakistan Military Academy. He is widely revered amongst the academic fraternity for his meritorious contributions to higher education both as an administrator and as a faculty. The General’s appointment as Pro-Rector (P&R) is expected to give a renewed impetus to NUST’s strategic planning and resource optimisation initiatives.



Pro-Rector P&R - Maj Gen (Retd) Muhammad Ali Khan

DxVision: AI Turning Tissue Scans into Instant Diagnoses

Replacing slow lab staining with fast, digital results

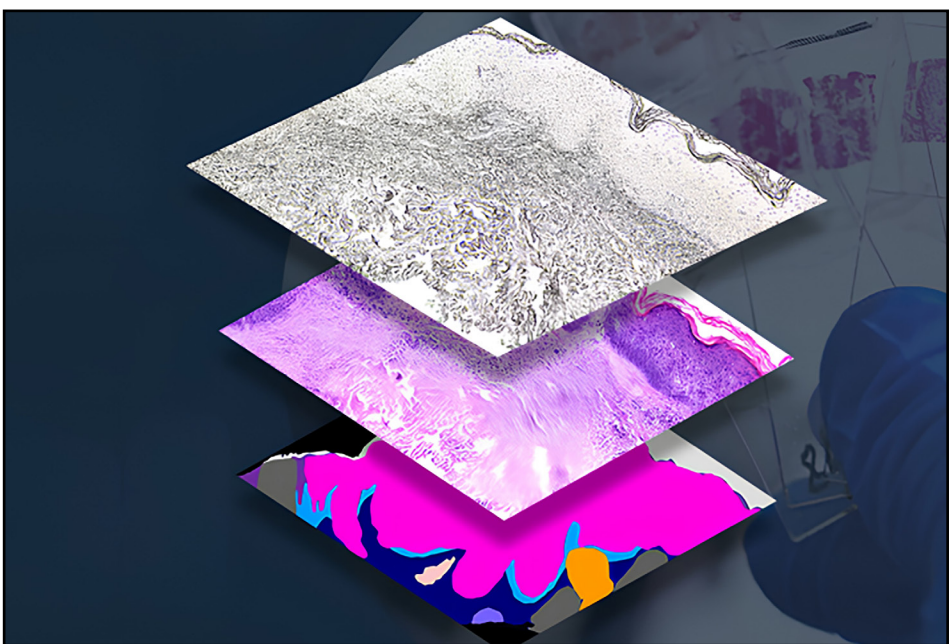


Dr Muhammad Usman Akram
Professor
PhD in Medical Image and Signal
Processing
College of Electrical & Mechanical
Engineering (CoEME-NUST)

Cancer remains one of the world’s most pressing healthcare challenges. Early and accurate diagnosis is critical, yet conventional pathology is slow, costly, and resource-intensive.

Traditional staining methods such as H&E, PAS, and IHC require chemicals, specialised equipment, skilled manpower, and several hours of processing, delaying diagnosis and treatment.

Delays in diagnosis can affect patient outcomes and increase healthcare costs. In many settings, limited resources and uneven access make the situation even more challenging. Pathology labs across the country face heavy workloads and rising demand, making faster and more efficient solutions essential.



THE BREAKTHROUGH

DxVision is a NUST spin-off that uses Artificial Intelligence to perform virtual staining. It turns unstained tissue scans into high-quality, diagnostic images-instantly. It is the result of years of research at the BIOMISA Lab in collaboration with NIDI Skin, USA, and is now a deployable healthcare innovation.

A whole-slide tissue image is scanned once. AI models then recreate different stain types-H&E, PAS, and IHC-like outputs-within minutes. Pathologists review the results earlier and make decisions with greater confidence.

DxVision reduces diagnostic turnaround time, improves lab efficiency, lowers costs, and reduces the use of chemicals and water, making pathology faster, cleaner, and more accessible.

IMPACT ON HEALTHCARE

DxVision is aimed at supporting Pakistan’s healthcare ecosystem by promoting early diagnosis, improving access to advanced technology, and reducing dependency on imported solutions.

It aligns with national goals for innovation, self-reliance, and sustainable healthcare development. DxVision is moving towards clinical validation and commercial deployment with pathology labs in Pakistan and international partners.

Protected by national and international patents, it has already gained recognition through global innovation programmes and competitions.

This is a proud example of NUST research creating real-world impact.

KEY HIGHLIGHTS

- Minutes, not hours
- No chemicals, no mess
- Faster, better diagnosis
- Scalable and sustainable solution

VOICES FROM THE EXPERTS

“DxVision has the potential to analyse images within minutes & revolutionise digital pathology. It saves time without compromising accuracy.”
— Pathologist

“A powerful example of how research can solve real problems in healthcare.”
— Inventor

BUILT FOR LOCAL CONDITIONS

- Cost-effective for resource-limited labs
- Reduced dependence on chemicals and infrastructure
- Designed for scalable deployment across Pakistan

POTENTIAL PARTNERS

- Pathology labs
- Dermatologists

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SDG 15: LIFE ON EARTH

AI Smart Traps are Changing Farming Forever

NUST innovation reduces pesticide use and boosts crop yield



For decades, farmers have relied on manual field inspection and excessive pesticide spraying to control pests. This approach is slow, expensive, and often ineffective. In many cases, pests are detected too late, causing major crop losses and unnecessary chemical use. Agriculture sector is the backbone of Pakistan’s economy, contributing over 20% to the total GDP and providing livelihoods to millions. The use of inefficient pesticide may lead to reduced crop yield and increased cost while harming the environment and human health at the same time.

THE BREAKTHROUGH

Researchers at SEECS NUST have developed AI-powered SMARTTRAPS, a smart pest monitoring system that detects insects in real time. These devices use cameras and Artificial Intelligence to identify pests and send instant alerts to

farmers. The device works in three steps. Firstly, the camera captures high-resolution insect images from the field. Secondly, analyse them using AI model to identify pest species. Thirdly, send data to a cloud dashboard and alert farmers in real time. Early detection enables farmers to act at the right time, reducing unnecessary pesticide use, lowering costs, and improving overall productivity.



This marks a shift from reactive to predictive agriculture.

DEPLOYMENT

The system has already been deployed at multiple commercial farms, including mango orchards in Multan, where it is helping farmers make informed decisions about pest control.



Dr Ayesha Hakim
Assistant Professor
PhD in Computer Science
School of Electrical Engineering & Computer Science (SEECS-NUST)

Solar powered for off-grid

KEY HIGHLIGHTS

- 30% reduction in pesticide use
- 10% increase in crop yield
- Covers approximately 5 acres per device
- Works in extreme climates (0°C to 50°C)

VOICES FROM THE FIELD

- “Before SMARTTRAPS, I couldn’t tell what pest was attacking my field, now I get alerts on my phone.”
—Farmer, Multan
- “This technology bridges the gap between research and real-world farming”
— Project Team

BUILT FOR LOCAL CONDITIONS

- Solar-powered for off-grid areas
- Designed for harsh climates
- Deployed in real farms across Pakistan

POTENTIAL PARTNERS

- Agritech Companies
- Agricultural Advisory Organisations
- Pesticide Companies
- Agricultural Farms

SDG 3: GOOD HEALTH & WELL-BEING

SMART KNEE DEVICE

Brings Real-Time Tracking to Rehabilitation

NUST develops digital system to monitor joint movement and support remote recovery



Dr Zartasha Mustansar
Professor
PhD in Computational Biomechanics Image Based Modelling
School of Interdisciplinary Engineering & Sciences (SINES-NUST)

Accurate measurement of knee movement is essential for effective recovery and rehabilitation. Traditional methods often rely on manual tools that depend on user skill, provide limited accuracy, and do not support real-time progress tracking outside clinical settings.

BREAKTHROUGH

Dr. Zartasha Mustansar at NUST

has developed a smart, non-invasive device that accurately measures knee movement using adjustable arms and a magnetic sensor. The system instantly displays results and wirelessly sends data to a cloud platform, allowing doctors to monitor recovery remotely.

IMPACT ON HEALTHCARE

The technology enables continuous

progress tracking and supports personalised rehabilitation plans. It reduces the need for frequent hospital visits, improves patient convenience, and enhances treatment outcomes through remote care.

SDG 4: QUALITY EDUCATION

XR-HIVE Lab Pioneers Immersive Technologies for Real-World Applications

NUST’s HIVE platform explores XR, haptics, and brain-computer interfaces for advanced interaction systems



XR-HIVE Lab

The XR HIVE (Hub of Immersive Virtual Environments) at SINES, NUST is a research laboratory focused on multimodal interaction to enhance immersion across diverse domains. Its primary areas of focus include:

- Extended Reality (XR, including VR/AR/MR)
- Computer Haptics
- Brain-Computer Interfaces (BCI)
- Computer Graphics and Vision

The laboratory develops enriched and intuitive human-computer interaction experiences for applications in training, education, simulation, healthcare, and industry.

Interdisciplinary Strengths

The XR, haptics, and BCI capabilities of the laboratory contribute towards broad national impact across multiple sectors.

Education

Immersive learning tools for complex subjects, improving spatial understanding, engagement, and retention.

Health

Stress management applications, neurofeedback, cognitive state monitoring, and rehabilitation or therapeutic tools through VR and BCI.

Defence & Security

High-fidelity training simulators for operators, enabling cost-effective, safe, and repeatable training whilst

reducing real-world risks and operational costs.

APPLICATION

- Virtual reality training simulators for multi-operator vehicles deployed in industry across Gujranwala and

Nowshera.

- VR-based training and testing systems for complex learning domains.
- Two serious games developed:
 - VR Stereo
 - Thrills and Spills



Phantom Omni Haptic Device



Meta Quest 2 VR HMD



Oculus Rift S VR HMD



HTV VIVE Pro 2 VR HMD



Logitech HOTAS x56



PICO 4 VR HMD



Insta360



Sensing Devices

CORE EXPERTISE

XR Development, 3D Modelling and Computer Graphics

Training Simulator Development

Serious Game Design for Learning

Chemical Education using VR and Molecular Modelling

Computational Chemistry (DFT Studies and MD Simulations)

PROJECT LEADS



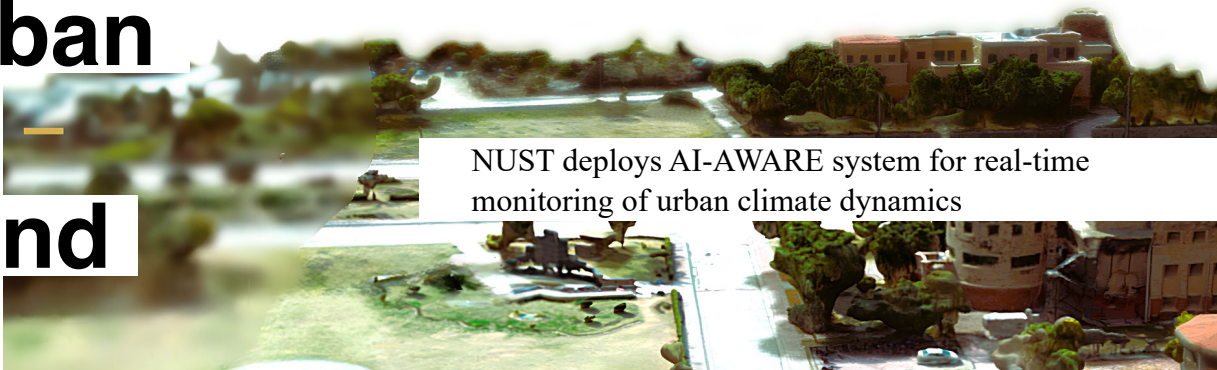
PI: Dr Shahzad Rasool
Associate Professor
PhD in Computer Engineering, Nanyang Technological University (NTU), Singapore
Postdoctoral Research at Fraunhofer Singapore (SINES-NUST)



Co-PI: Dr Uzma Habib
Associate Professor
PhD from Heidelberg University, Germany (SINES-NUST)

SDG 11: SUSTAINABLE CITIES & COMMUNITIES

AI-Powered Urban Sensing Maps Microclimate and Heat Patterns



Urban areas are facing rising temperatures, changing climate patterns, and growing environmental concerns. Traditional monitoring methods often fail to capture local climate changes accurately, limiting effective urban planning and response.

BREAKTHROUGH

NUST's AI-AWARE system combines sensors, Internet of Things (IoT) technologies, and Artificial Intelligence to monitor environmental conditions in real time. The system collects and analyses data to identify microclimate variations and heat patterns across cities.

IMPACT ON ENVIRONMENT

The technology provides detailed insights into urban climate behaviour, helping improve environmental management and supporting evidence-based planning. It can also contribute to

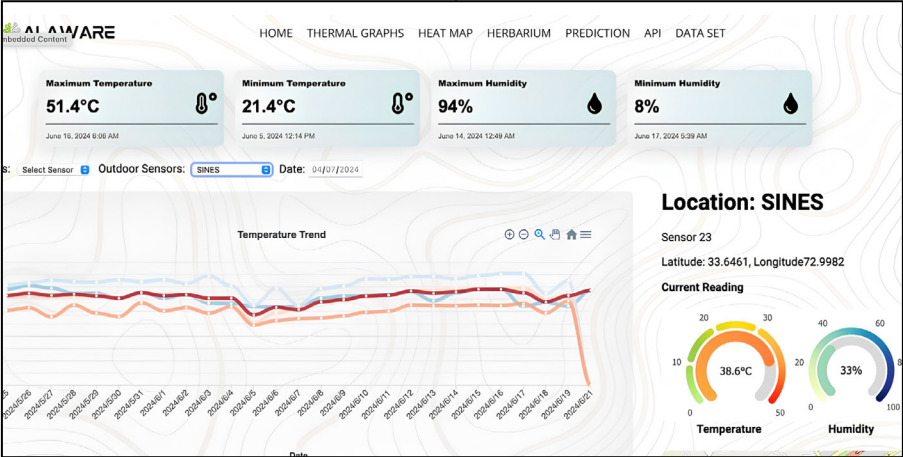
better public health strategies and more sustainable city development.

NATIONAL RELEVANCE

AI-AWARE supports the development of climate-resilient and sustainable cities. By enabling smarter planning and better climate monitoring, it can help urban planners, climate strategists, and researchers to address future environmental challenges and improve urban living standards.



Dr. Salman Atif
Associate Professor
PhD in Geography & Environment
School of Civil and Environmental Engineering (SCEE-NUST)

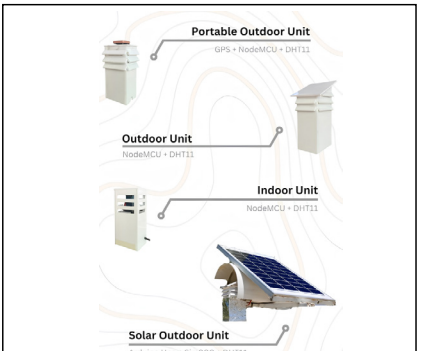


POTENTIAL PARTNERS

- Urban Planners
- Climate Strategists
- Climatologists

KEY HIGHLIGHTS

- Mapped 8000 individual trees across 27 species
- Augmented Reality & 3D Modelling for simulation
- Web based portal for real-time data



SDG 3: GOOD HEALTH & WELL-BEING

From Superfood to Sweet: Algae-Based Candies Offer a Healthier Treat

NUST researchers turn spirulina and chlorella into hard candies packed with nutrition and taste



Dr Hussnain Ahmed Janjua
Professor
PhD in Microbial Molecular Biology
Atta-Ur-Rahman School of Applied Biosciences (ASAB-NUST)

Spirulina and chlorella are nutrient-rich superfoods known for their health benefits. However, their strong earthy taste and gritty texture often limit their consumption to powders and tablets, making them less appealing to many consumers.

BREAKTHROUGH

NUST researchers developed innovative hard candies fortified

with spirulina and chlorella, creating a more enjoyable way to consume these superfoods. The candies are naturally sweet, portable, shelf-stable, and designed to mask unpleasant flavours without relying heavily on artificial additives.

IMPACT ON NUTRACEUTICAL

The product showed strong consumer acceptance while maintaining important nutrients during processing. It retains key compounds such as vitamins, chlorophyll, and antioxidants, offering health benefits comparable to foods like berries and green tea.

NATIONAL RELEVANCE

This innovation supports the growing demand for healthier and clean-label food products. With future possibilities such as sugar-free and probiotic variants, along with large-scale industry collaboration, it can contribute to improved nutrition and functional food development.

WHY IT MATTERS

A HEALTHY TREAT FOR EVERYONE

- Children reluctant to take supplements
- Adults needing quick, healthy energy
- Older adults or individuals with low appetite

- Athletes and active individuals

POTENTIAL PARTNERS

- Nutraceutical Companies
- Nutrition Professionals
- Health related Government Organisations
- Academic Institutions



With thoughtful innovation, even indulgent snacks can contribute to better health. **Algae-based candies** are a step towards making healthy eating more accessible and enjoyable for everyone.

AI & Satellite Data Enabling Faster Property Tax Estimation

A data-driven approach for accurate and efficient tax assessment



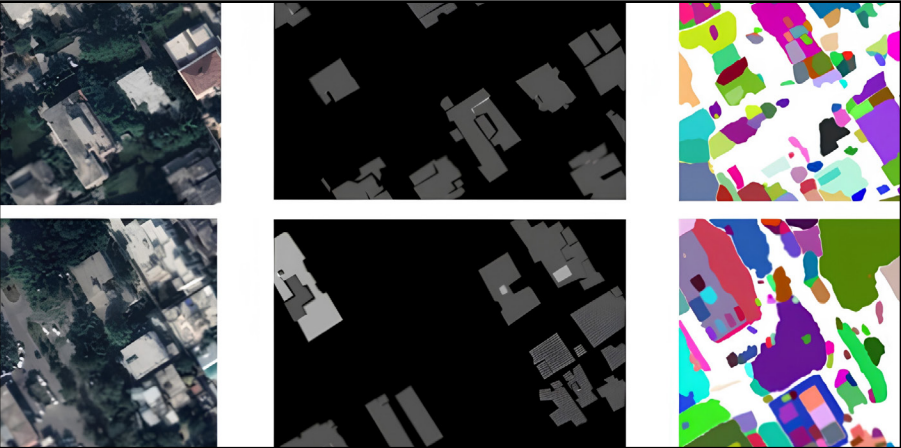
Dr Muhammad Latif Anjum
Assistant Professor
PhD in Robotics and Computer Vision
School of Electrical Engineering & Computer Science (SEECs-NUST)

Property tax systems often rely on manual surveys and outdated records, making the process slow, costly, and prone to errors. As cities grow rapidly, many properties remain under-assessed, affecting tax collection and urban management. **BREAKTHROUGH** Researchers developed an AI-powered system that combines satellite imagery with automated image analysis to detect buildings and monitor structural changes. The technology enables quick



and efficient property assessment across large urban areas. **IMPACT OF THE AUTOMATED SYSTEM** The system supports faster property identification, reduces data collection costs, and improves transparency in tax systems. It also enables large-scale property evaluation without the need for physical inspections. **NATIONAL RELEVANCE** This innovation can help strengthen property tax collection in Pakistan by expanding the taxable base and

improving fairness. It also supports better urban planning and more effective governance through data-driven decision-making.



KEY HIGHLIGHTS

- AI and satellite data enable large-scale property detection and monitoring
- Faster, more accurate, and transparent tax assessment process
- Reduces manual surveys, costs, and human errors
- Improved revenue generation and support for urban planning

NUST builds scalable CO₂ Capturing Unit for low-carbon future



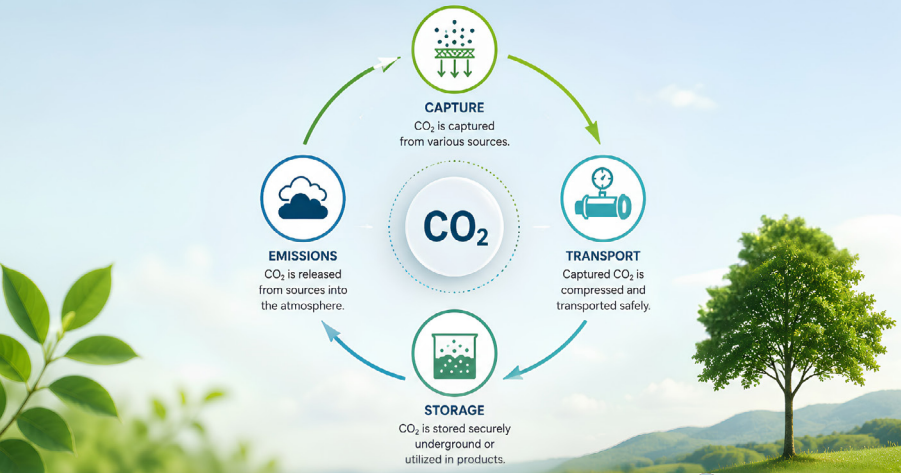
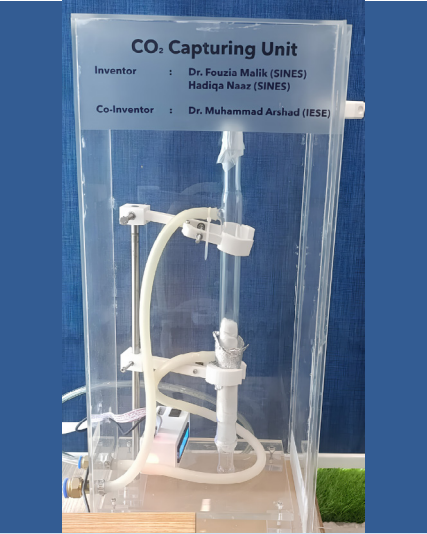
Dr Fouzia Perveen Malik
Professor
PhD in Physical Chemistry
School of Interdisciplinary Engineering & Sciences (SINES-NUST)

Industries worldwide are under growing pressure to reduce carbon emissions and adopt cleaner practices. Sectors such as cement, power generation, and manufacturing face increasing environmental and regulatory demands, while Pakistan also continues to deal with rising industrial

emissions and climate challenges. **BREAKTHROUGH** The researcher has developed an innovative CO₂ Capturing Unit designed for efficient and scalable carbon capture. Using advanced materials and a modular design, the system offers high capture efficiency with lower operational costs and can be integrated into existing industrial setups. **IMPACT ON CARBON REDUCTION** The technology enables selective carbon capture while maintaining energy efficiency, helping industries reduce emissions and support decarbonisation goals. It also creates opportunities for industrial partnerships, technology licensing, and future commercial applications. **NATIONAL RELEVANCE** Designed with local industry needs in mind, this solution offers a cost-effective approach for

Pakistan’s industrial sector. It can support environmental compliance, strengthen climate action efforts, and contribute towards a more sustainable and low-carbon economy. **POTENTIAL PARTNERS**

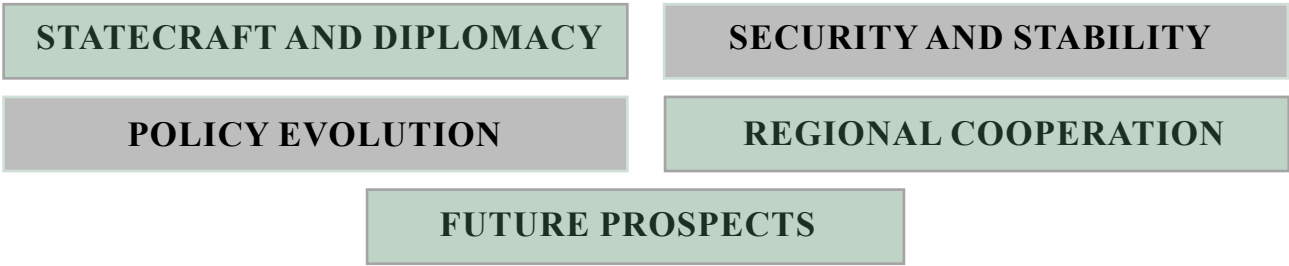
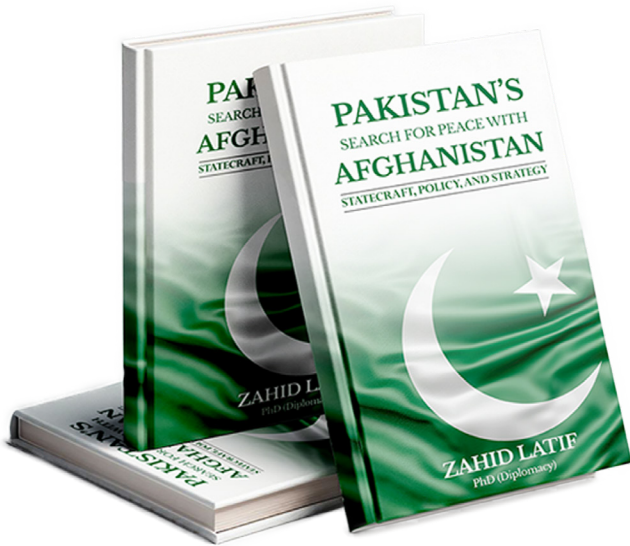
- Power Generation Sector
- Oil & Gas Industry
- Chemical & Fertiliser Industry
- Carbon Capture and Climate Tech Industry
- Cement Industry



NUST’s CO₂ Capturing Unit represents a significant step towards sustainable industrial transformation, offering a locally optimised solution to a **global climate challenge**.

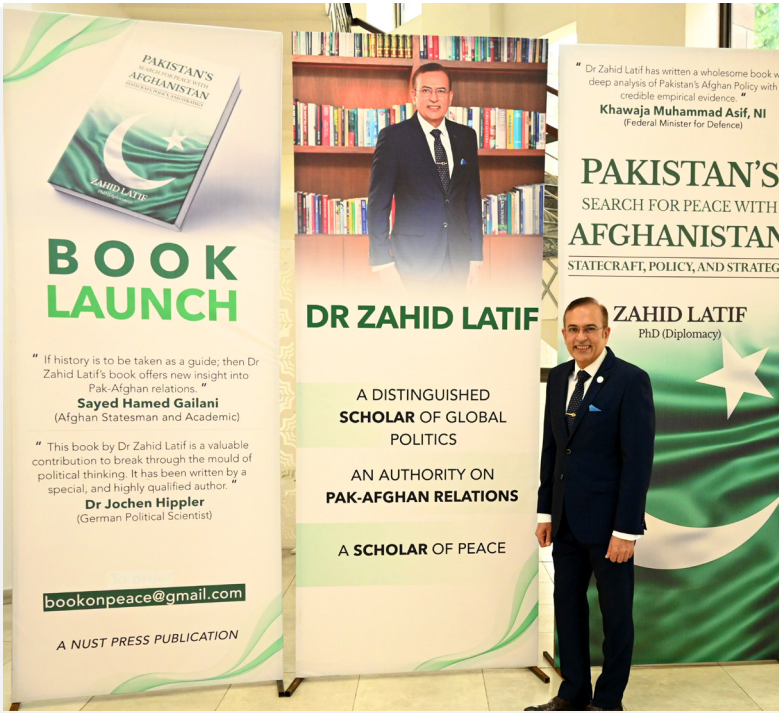
IN THE SPOTLIGHT

PAKISTAN’S
SEARCH FOR PEACE WITH
AFGHANISTAN
STATECRAFT, POLICY, AND STRATEGY



A timely and scholarly contribution to strategic studies, the book **Pakistan’s Search for Peace with Afghanistan: Statecraft, Policy and Strategy** examines Pakistan’s Afghan policy from the post-Cold War era to the US withdrawal from Afghanistan in August 2021. Authored by **Dr Zahid Latif**, Rector NUST, the book critically analyses why efforts to achieve lasting peace and stability remained less effective than anticipated and offers insights for future policy directions. Combining scholarly research with

practical experience, the author explores the interplay of diplomacy, security, regional dynamics, and statecraft in shaping Pakistan-Afghanistan relations. The book highlights the importance of informed policymaking and strategic foresight in addressing one of the region’s most complex challenges. This work serves as a valuable resource for students, researchers, policymakers, and practitioners of international relations, strategic studies, and regional security, contributing to the broader discourse on peace, cooperation, and stability.



What is Agentic AI?

Agentic AI systems act autonomously to make decisions, and achieve goals, just like a smart agent. They perceive, reason, plan, and act to solve complex problems with minimal

human intervention.

4-STEP WORKFLOW

- Perceive – Understand the environment.
- Reason – Analyse and make sense of data.
- Plan – Set goals and determine steps.
- Act – Execute actions and learn from results.

Autonomous. Adaptive. Accountable.
Agentic AI, working for you, achieving with you.

Student Innovation Spotlight

SEISMIC PERFORMANCE EVALUATION OF 3D PRINTED LC3 WALLS

This final year project, supervised by Dr Muhammad Usman from NUST School of Civil and Environmental Engineering (SCEE), investigates the seismic behaviour of 3D printed LC3 (Limestone Calcined Clay Cement) wall panels through experimental testing and nonlinear analysis.

KEY OBJECTIVES

- Evaluate out-of-plane seismic performance of 3D printed LC3 walls

- Assess the influence of printing parameters and material composition on structural behaviour
- Develop a reliable analytical model for performance prediction

IMPACT & OUTCOMES

The study demonstrates the potential of sustainable 3D printed construction in earthquake-resilient housing and supports the advancement of eco-friendly building technologies in Pakistan.

Team Members
Irshad Alam, Kamran Aslam, Zeeshan Ashraf, Wajahat Khan

LearnOBot: Transforming STEAM Education Through Robotics & AI

Among many startups housed at NSTP NUST, LearnOBot is an innovative Ed-tech empowering future innovators through hands-on Robotics learning.

OVERVIEW

LearnOBot delivers practical STEAM education through Robotics, Coding, AI, and hands-on innovation programmes

technologies to inspire creativity, problem-solving, and future-ready skills. Its Robotics and AI training programmes help students develop technical confidence through project based learning, competitions, and smart educational tools.

MAKING AN IMPACT

- Inspiring future innovators
- Enhancing practical STEAM learning
- Building problem-solving skills
- Promoting creativity & teamwork
- Supporting smart education initiatives

ABOUT CO-FOUNDER

Mr Muhammad Faisal Laghari, serves as the Co-Founder and CEO of LearnOBot. He is a NUST Alumnus with a demonstrated history of working in the education management industry.

designed for schools and young learners. The platform combines interactive learning with emerging

Expert Voice

“Engineering Must Solve Real Problems, Not Just Equations”

WHAT INSPIRES ME

Bridging theory with real-world applications through industrial experience from ships, oil companies, and the automotive sector, helping students relate concepts to practical impact.

MOMENTS OF PRIDE

Student-led projects solving real

industrial problems, including Tribology research with Afton UK and the development of camshaft and crankshaft inspection machines.

BEYOND THE MISCONCEPTION

Mechanical Engineering today is multidisciplinary, integrating sensors, electronics, software, and instrumentation to build complete

systems.

MY ADVICE TO RESEARCHERS

Focus on applied research that solves real-world problems. Convert practical challenges into meaningful Engineering solutions instead of relying only on memorized formulas.

Dr Riaz Ahmed Mufti
Professor
School of Mechanical & Manufacturing Engineering (SMME-NUST)

NUST RESEARCH IN NUMBERS



NUST

NATIONAL UNIVERSITY OF SCIENCES & TECHNOLOGY

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