

# Islamabad Campus



## Director

**Dr. Waseem Shahzad**

Professor

HEC approved PhD Supervisor

PhD (CS), NUCES, Islamabad (2010)

MS (CS), NUCES, Islamabad (2008)

MIT, UAAR, Rawalpindi (2004)

The Islamabad campus is located along the Srinagar Highway. It presents a striking view of the picturesque capital city known for its beauty and tranquillity. The campus being located in an exquisite locale bequeaths a sight of the city that is captivating and delightful. The campus expands over 15-acres of land and is located right in the academic hub of the city. The covered area of the campus is steadily expanding and its study programs are continually evolving. The newly constructed eight stories academic block reflects the futuristic approach of the campus.

The campus has highly qualified, fully committed and professionally stimulated faculty which brings academic excellence to the university. The faculty possesses excellence in teaching competence, along with being fully synchronized and geared up, to instruct and embrace the up-to-date progress and developments in science and technology. The faculty excels in their domain; being accomplished researchers, contributors and developers in their fields of endeavour. The scope of research carried out at the campus spans Intelligent Networks, Software Testing, Software Engineering, Machine Intelligence, Image Processing, Neural Networks Embedded Systems, RF Systems and Control Systems.

Undergraduate programs are offered in Computer Science, Software Engineering, Artificial Intelligence, Data Science, Cyber Security Electrical Engineering, Robotics, Business Administration, Business Analytics and Accounting & Finance. In addition, the campus offers MS and

PhD programs in Computer Science, Software Engineering, Artificial Intelligence, Data Science, Computer Networks & Security, Electrical Engineering and Management Sciences. Graduates of this campus are well-received by the industry and hold prominent positions in many national and multinational corporations. A large number of university alumni are serving in prestigious institutions and organizations across the world like Microsoft, Google, Amazon, Facebook, Oracle, IBM, Telenor, Jazz and Huawei.

The campus provides state of the art facilities in academic as well as extra-curricular activities. Spacious and well-equipped computer and engineering labs impart practical orientation to the students in their respective areas of study. Audio-visually supported and well-furnished class rooms offer a favourable and constructive learning environment to the students.

In order to contribute to the physical fitness of students and assist them in unwinding, the campus extends sports facilities in both indoor and outdoor games like cricket, football, basketball, tennis, badminton, table tennis, volleyball and chess. Besides sports, healthy competitions in programming are also arranged and are a source of both mental stimulation as well as fun for students. NASCON, a national level competition for the students organized by the campus is highly appreciated by the industry and the educational institutions all over the country. The campus has over 24 student societies and clubs to

promote co-curricular activities among the students and to give them a sense of responsibility and ownership in order to inculcate leadership potential in them.

## Programs offered at Islamabad Campus:

### BBA

BS (Accounting & Finance)

BS (Artificial Intelligence)

BS (Business Analytics)

BS (Computer Science)

BS (Cyber Security)

BS (Data Science)

BS (Electrical Engineering)

BS (Financial Technologies)

BS (Software Engineering)

### MBA

MS (Artificial Intelligence)

MS (Business Analytics)

MS (Computer Networks and Security)

MS (Computer Science)

MS (Data Science)

MS (Electrical Engineering)

MS (Management Sciences)

MS (Software Engineering)

PhD (Computer Science)

PhD (Electrical Engineering)

PhD (Management Sciences)

PhD (Software Engineering)



## Artificial Intelligence Diagnostics Lab (AIDL)

The AI lab at our institution is a leading facility that employs advanced machine learning, deep learning, and Topological Data Analysis (TDA) techniques for brain tumor segmentation and classification. The lab uses standardized BRATS data and patient data provided by Agha Khan Hospitals to develop effective algorithms that can accurately detect and classify brain tumors.

The lab's primary objective is to provide accurate and reliable results to help physicians in the diagnosis and treatment of brain tumors. The lab employs a collaborative approach, with experts from various disciplines working together to ensure the highest level of accuracy and efficiency.

### Areas of Expertise:

1. Medical Image Analysis
2. Topological Data Analysis
3. Brain Tumor Segmentation using Deep features and Topological Data Analysis:
4. Natural Language Processing
5. Genomics
6. Information Fusion

### Research Team

The AID lab consists of a Co-PI who oversees its operations, a Research Associate who assists with day-to-day management, and several Research Assistants who are responsible for conducting research. The team includes both PhD students who conduct advanced research in their area of study and contribute to research publications, as well as MS students who assist the Research Assistants with their tasks and carry out their own research projects under their guidance.

## Partners and Collaborators

1. Aga Khan University Hospital, Karachi
2. TDA (Topological Data Analysis) Lab, FAST NUCES Islamabad
3. Queen's University, Kingston, Canada

## Research Grants

1. Title: Virtual Biopsy for Classification, Outcome prediction and Treatment planning of brain tumors (ViBCOT)  
Source of Funding: HEC
2. Title: Brain Tumor Segmentation  
Source of Funding: HEC
3. Title: Algorithmic Approaches for Classifying Primary Brain Tumors and Predicting Survival Using Conventional MRI Scans  
Source of Funding: Queen University

## Projects

AID lab is currently conducting research in the following areas of AI:

1. **Medical Image Processing:**  
Our lab specializes in developing cutting-edge brain tumor segmentation algorithms using deep learning techniques. We focus on using a dataset of MRI scans from Aga Khan University, which is preprocessed to standardize the data, and train a convolutional neural network to accurately segment out brain tumors from new MRI scans. We evaluate our algorithm's performance using metrics such as dice similarity coefficient (DSC), with the ultimate goal of advancing the field of medical image analysis by improving the accuracy and efficiency of brain tumor segmentation. This could



have significant implications for the diagnosis and treatment of brain cancer patients, and our lab is committed to pushing the boundaries of this exciting and vital area of research.

**2. Patch Based Segmentation:**

In this module of the project, our focus lies on exploring diverse patching methodologies that can have a substantial impact on the accuracy of brain tumor segmentation. Specifically, we are investigating the effectiveness of topological data analysis and connected component analysis in enhancing the quality of brain MRI patches. These techniques aim to ensure the preservation of complete tumor information and secure tumor boundaries, thereby improving the overall segmentation results.

**3. Brain Tumor Segmentation using Handcrafted and Deep Features:**

The objective of the project is to

create a novel method for segmenting brain tumors that merges handcrafted features with deep features. The handcrafted features are based on Topological Data Analysis (TDA) technique, which can capture unique attributes of the data. By integrating these two types of features, the proposed method can harness the benefits of both approaches and potentially enhance the precision and resilience of brain tumor segmentation. The advancement of such a technique can have important consequences for advancing the detection and therapy of brain tumors.

**4. Fusion of medical imaging and electronic health records**

Our lab specializes in the fusion of medical imaging and electronic health records (EHRs) to unlock new insights into

patient health. By combining these two sources of data, we are able to build comprehensive, patient-specific models that enable more accurate diagnosis and treatment planning.

**5. Federated Learning**

Federated learning is a machine learning technique that allows multiple devices to train a shared model while keeping data locally on each device. This approach is helpful for brain tumor segmentation as it allows for collaboration while maintaining privacy and security. It can also be more cost-effective than traditional centralized methods and can utilize under-utilized compute resources for significant cost savings.



## Data Insight Research Lab

Data Science is poised to become one of the most intensively research areas of Computer Science discipline. The Data Insight Lab at National University of Computer and Emerging Science (NUCES), Islamabad focuses its research in all areas of Data Science such as Data Mining & Machine Learning, Big Data Management, Social Data Analytics, Internet of Things (IoT), and Computer Vision. We are working on cutting edge developments in these areas. The goal of the new research lab is to build systems and algorithms to extract knowledge, find patterns, generate insights and predictions from diverse data for various applications and visualization. The lab will provide a platform for the researchers to build a collaborative research culture within and outside the school including local and international industries. Also the lab will enable undergraduate to postgraduate and masters to PhD pathways.

### Research Spectrum

The primary focuses of the lab is to do research in following areas along with relevant projects.



## Big Data Management

Big Data is a topic of great contemporary interest given the proliferation of Big Data repositories that are now available online. Big Data repositories are typically created from diverse and inter-linked online data and contain potentially valuable information that needs to be mined before it can be presented in usable form to an end-user. The primary challenge in Data Analytics that has emerged in recent times is the management of Big Data in order for real time analysis to be performed. Currently available mining methods cannot scale to petabyte and exabyte scale datasets which are currently available. Research in this area is required that will mine such large data repositories in real time while returning knowledge in the form of actionable patterns in real time that can be used by an end-user to support real time decision making.

## Data Mining & Machine Learning

Data streams are open ended collections of data that do not have a finite length. Classical data mining methods developed for static and fixed size datasets do not apply to data streams. Research in this area

has flourished over the last 15 years or so but some open research issues remain. Some of these open issues include the methods that will detect concept drift. In most data streams changes in the underlying stochastic data distribution occur periodically and such changes need to be detected so that models can be kept up to date with the data in real time. The other major challenge comes from data streamlining in from Big Data repositories. New scalable methods that can mine ultra-high data arrival rates are needed while ensuring that model accuracy is not compromised by the higher throughput rates that are achieved.

## Social Data Analytics

Data has always been a critical component of any business model. It has been used mostly to detect causal trends between two overt variables for the purpose of optimising an objective. In recent times, the extent of digitalisation has made it easy to collect abundance of data which has resulted in gigabytes of data not necessarily between variables with overt relations. This abundance of data has resulted in the discipline of data science which deals with extracting latent information embedded in seemingly unrelated or loosely related variables. Text processing goes a step further and deals with techniques to extract information embedded in texts expressed in a natural language. It is challenging as natural language is unstructured, however it can be successfully used for a huge range of applications.

## Computer Vision

Information visualisation is at the heart of any data analytics exercise. Visualisation is a very powerful and effective way of disseminating knowledge. From simple charts to more sophisticated form such as Principal Component plots, Multidimensional Scaling plots, etc the core intention in a simple visual manner that will assist decision makers in making the right decision. Methods used range from Mathematical/Statistical methods to newly developed types of charts/diagrams developed in the data analytics for modelling network behaviour in computer and social media networks. This again is a well-established area but requires new methods for systems that are specific to problems that arise in computer science.

## Research Team

The lab has established a strong research team from both industry and academia. The academic research team consists of both international and national researchers plus PhD and Master students.



## Funding Grants

1. National Research Program for Universities (NRPU 2022) (PKR 7,654,500)
2. NESCOM (2022) (PKR 2,000,000)
3. Capacity Building Grant (2020) (PKR 1,375,000)  
Faculty Research Support (2020) (PKR. 590,000)

## Publications

The lab has published one book and more than 120 peer reviewed journals, conferences and workshops papers including in IEEE, ACM, and VLDB. The lab recent research has been published in VLDB Journal and in Information Systems (ranked A\* in Computing Research and Education Association CORE), in Expert Systems with Applications (Q1 in Scimago Journal Ranking SJR ), and in ICDM (ranked A\* conference in CORE).

## On Going Projects



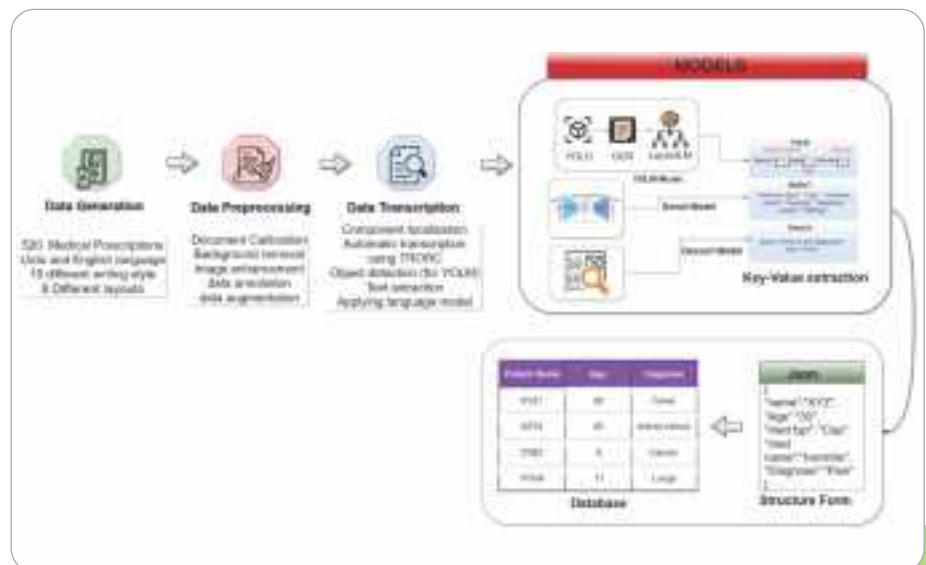
## HEC-NRPU 2021 Grant

Professor Muhammad Asif Naeem as a Principal Investigator (PI) has received National Research Program for Universities (NRPU) 2021 research grant for his project titled “Make Data Useful from Rubble: An AI-based Approach to Digitize Handwritten Medical Prescriptions and to Build a

Recommender System”. The grant is funded by Higher Education Commission (HEC) of Pakistan. The total funding amount is Rs. 7,108,500/- and the duration of the project is 24 months. As one of the requirements of the grant, a research lab with name [Data Insight](#) has been established at the School of Computing, National University of Computer and Emerging Science (NUCES), Islamabad Campus. The project will offer new job opportunities for our research students and open up new research collaboration opportunities with national and international researchers and industry partners in this domain. The graphical overview of the project is given below.

## Project Team:

1. Professor Muhammad Asif Naeem (PI)
2. Iqra Ali (Team Lead)
3. Warsha Khan (Research Assistant)
4. Muhammad Arsalan (Research Assistant)



### A Funded Project by NESCOM

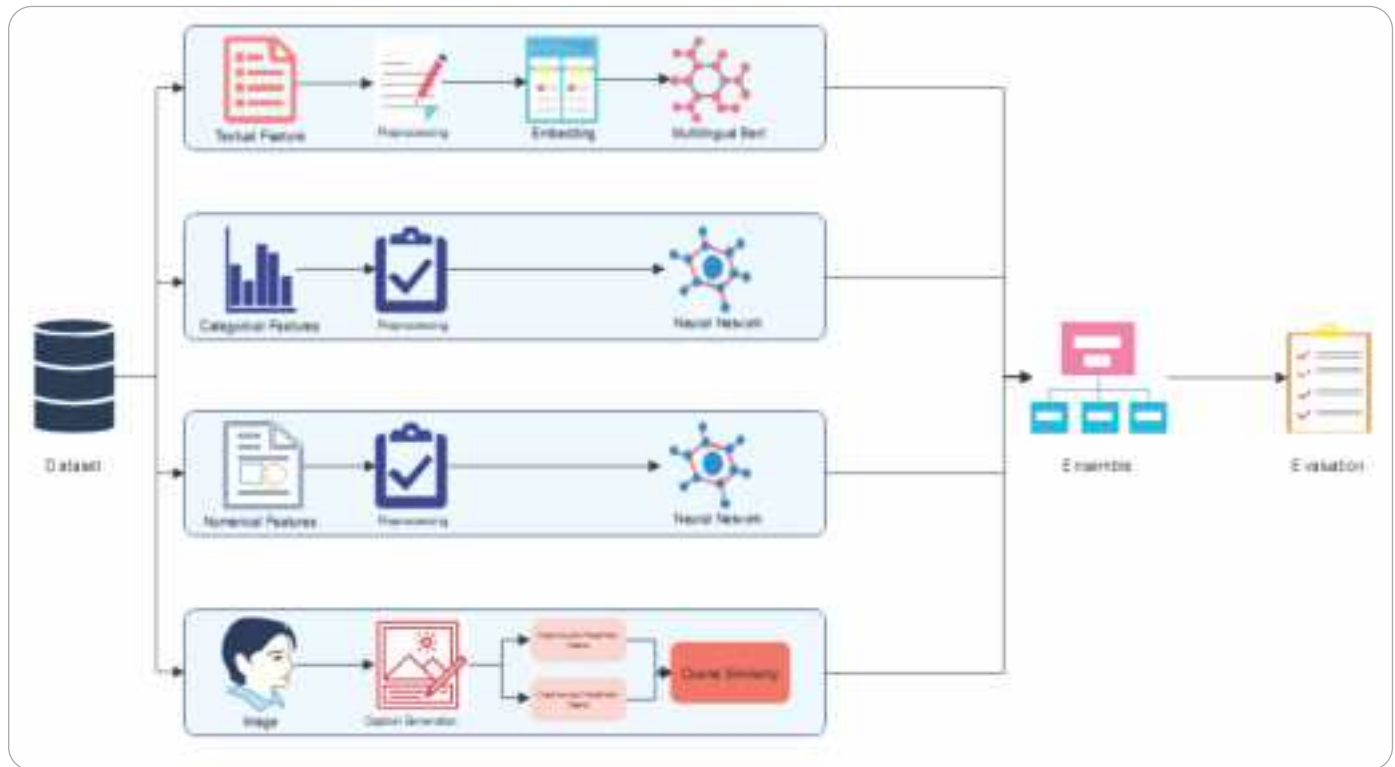
Professor Dr Muhammad Asif Naeem as a Principal Investigator has received a grant for RAC project funded by NESCOM, Pakistan. The project is about Detecting Fake News using Machine Learning. We propose a bilingual approach for which we will collect bilingual dataset with enhanced number of features e.g., words per sentence, source of the

news, domain of the news, language of the text etc. We will not only rely on text-based classification, but we will also go with domain-wise classification (e.g., Politics, Health, World, Sport), source-wise classification, sentiment-based classification, and opinion-based classification. The abstract level execution architecture for the proposed approach is shown below.

### Project Team:

1. Professor Muhammad Asif Naeem (PI)
2. Muhammad Saad Munir (Research Assistant)

To know more about the lab and our projects, visit us at <http://isb.nu.edu.pk/datainsight/>.  
Email: [datainsight.isb@nu.edu.pk](mailto:datainsight.isb@nu.edu.pk)





Marine & Aerial Robotics System (MARS) research lab is established with the objective of building indigenous capacity to design and develop real world systems, especially in the field of marine science and technology. Several projects are being initiated with the help of national and international collaborative partners with active participation from both undergraduate and graduate students. The lab aims to play a key role in enabling research culture in the department while producing quality work. The areas of expertise and ongoing projects showcase the lab's commitment to cutting-edge research and development.

### Area of Expertise

1. Magneto Inductive/Resonance Communication Systems
2. Underwater Wireless Sensor Networks
3. Design and Development of Indigenous Embedded System Solutions
4. RISC-V architecture

### Ongoing Projects

- **Design of Full Duplex Underwater MI sensor Node**  
Magneto-Inductive (MI) communication has emerged as a real alternate mode of communication for challenging and complex environment such as indoor, underground and underwater. MI communication offers a lot of advantages and therefore attracts various

applications but the use of lower frequencies to generate quasi static magnetic field, limits the data rate. With growing demand for using MI technology in underwater applications, there is also a demand for higher data-rates. Achieving higher data rate is highly required. To increase the data rate of MI based system we are working on a full duplex communication system that doubles the existing data rate and significantly improve and enhance the capabilities. This project will enable real-time monitoring of underwater environments.



*Figure 1: Demonstration of Full Duplex communication using 2D coils designed in the lab*

- **Design of 32-bit RISC-V Processor using Synthesizable SystemC and High-level Synthesis**

The worldwide market for semiconductor Intellectual Property (IP) blocks is expected to approach 8 billion by 2019. A growing variety of these IP blocks populates any System-on-Chip (SoC) for embedded systems or Internet-of-Things (IoT) and therefore SoC architects seek the right mix of components for the target application domain, while being pressured by stringent

time-to-market constraints. To cope with design complexity, it is necessary to raise the level of abstraction by embracing system-level design methods. These include the use of high-level programming languages, like C/C++ and SystemC, for design specification and the application of High-Level Synthesis (HLS) for design optimization. This project thus works on the design and implementation of a 32-bit RISC-V processor core with HLS to contribute in the development of more efficient and powerful processors for use in a variety of applications

- **Low Power Scalable Multi-Core Embedded System**

Multi-core processor-based system requirements emerge with an increase in demand of computational power. But these multi-core processors are typically accompanied with high power consumption. In this project, a micro-operating system is being developed for execution of a multithreaded embedded program with shared memory on multicore system. The user program is divided into multiple threads with their own stacks and capability to context switch for improved throughput.

### Collaborators & Partners:

The current projects at MARS lab are in collaboration with both national and international academic as well as research organizations, such as Harbin Engineering University (China), Bremen University (Germany), National R&D organization (NESCOM), etc.

## Parallel Computing and Networks (PCN) Lab

The Parallel Computing and Networks research group (PCN) was conceived based on the interconnected research areas of the founders in 2014 including parallel and distributed computing, as well as IP, wireless, and ad-hoc networks. In recent years, the group has also broadened its research agenda to encompass new fields, such as cyber security, temporal information retrieval, social network analysis, and online privacy concerns. By leveraging our expertise in these diverse domains, we aim to drive advances in computing and networking that will benefit society and contribute to the frontiers of research in these rapidly evolving fields.

### Research Collaborations

PCN has enjoyed a thriving partnership with the Distributed and Parallel Systems (DPS) research group at the University of Klagenfurt in Austria. This collaboration, financed by the OeAD-GmbH/ICM on behalf of the Federal Ministry of Science, Research and Economics – BMWF, Austria, provides invaluable international exposure to PCN research students at NUCES, Islamabad. Through this collaboration, students receive expert guidance from esteemed researchers in the field of parallel and distributed computing.

Based on the accreditation and curriculum development activities of the PCN members, we are participating in an Erasmus Capacity Building Project, i.e., Strategic Support for Accreditation of Programs and Internationalization at South Asian Higher Education Institutes / SSAPI (2021- 2023) on behalf of National University of Computer and Emerging Sciences, Islamabad, Pakistan.

### Current Projects

#### CyberMuhafiz: A Framework for Analysis, Characterization, and Forecasting Cyber Attacks

Funded by HEC NRP 2021

The importance of cybersecurity in modern times is vital due to the increased usage of technology in various domains such as e-health, e-banking, and social networks. Cyber-attacks are becoming more prevalent and are a serious threat to organizations. A comprehensive framework is needed to characterize and predict potential cyber threats. This proposal suggests the use of honeypots to analyze, classify, and predict malicious cyber interactions. AI-based characterization models will detect known and zero-day attacks, and a security framework will gauge security levels of organizations and public interfaces. The proposed product includes security rules and regulations and will forecast potentially malicious activity based on AI-trained forecasting models and a Bayesian network. This will enable individual customers, organizations, and other governmental agencies to take the required countermeasures before an actual attack event occurs.

#### NRP 2021: NAS-News Analytics Service using Spatiotemporal Information

Funded by HEC NRP 2021

The article discusses how human decision-making depends on cognitive processing, but people often ignore information that conflicts with their beliefs. Web news documents provide rich cognitive information that can be useful for forming policies, but the geographical and temporal patterns in the collection of news reports are important for building a cognitive information retrieval system. The study proposes novel approaches

to determine the geo-temporal specificity and focus of news documents, including defining geo-temporal classes, engineering news geo-temporal features, and proposing new text classification methods. Data science and machine learning approaches will be used to detect and classify impactful news, and the overall findings will demonstrate how valuable geo-temporal insights can enhance the performance of information retrieval systems. The proposed system will map events based on their severity onto a map, which can be used to guide drones or personnel on the ground.

#### Artificial Intelligence Based Network Anomaly Detection System

Funded by National Engineering and Scientific Commission Pakistan

The increasing sophistication of cyber-attacks has made it difficult to detect and prevent them using traditional methods such as signature-based intrusion detection systems. As a result, more advanced techniques like Artificial Intelligence (AI) are being developed to identify suspicious activities in real-time. However, most research in this field has focused on synthetically generated data, which does not fully reflect the complexity of real-world network traffic. Therefore, this research presents an experiment where a network infrastructure equipped with a honeypot was deployed to capture real-world network data. By using real-world data, the researchers were able to demonstrate the effectiveness of AI models in detecting threats and preventing network disruptions, which contributes to the growing body of research on the application of AI in network security.



## Heuristics Analysis of Malwares in Sandbox Environment

Funded by National Engineering and Scientific Commission Pakistan

Currently, malware has been a critical threat that attacks multiple platforms such as Windows, Android, IoT etc. However, with the evolution of modern and sophisticated malware categories, it has now become difficult to differentiate between malware and non-malware creating a challenging task to examine the behavior of malware applications. Due to the limitations of static-based detection mechanisms, we propose a heuristic machine learning-based malware classification and detection technique that utilizes the static and dynamic features to increase the malware detection rate. The dataset employed in the study comprises 8400 malware applications, which were collected

using different platforms. Experimental results show that the proposed malware detection and classification mechanism is able to detect and classify unknown malicious applications into malware and non-malware categories using several machine learning algorithms such as SVM, Random Forest, and XGBoost. Moreover, it has been noticed that data from network activities can be used to classify and identify malware more appropriately. The outcomes of the study illustrate that random forest has outperformed by attaining an accuracy of 0.96 for malware classification.

### Faculty Members:

1. Assoc. Prof. Dr. Kashif Munir
2. Assit. Prof. Dr. Subhan Ullah
3. Mr. Ameen Chilwan

Lab Home Page: [www.pcn.net.p](http://www.pcn.net.p)

### Co-Directors & Founding Members:

1. Prof. Dr. Muhammad Arshad Islam, NUCES-FAST Islamabad
2. Prof. Dr. Muhammad Aleem, NUCES-FAST Islamabad
3. Assoc. Prof. Dr. Muhammad Azhar Iqbal, University of Lancaster, UK



## Project Introduction:

### Hacked Reality:

Hacked Reality is a VR based cyber security awareness training game that has been developed to provide an immersive experience for players and users. The game offers multiple modes and difficulty levels, ensuring that players of all skill levels are challenged and engaged. Through interactive scenarios and challenging gameplay, the game aims to increase cyber security awareness and provide valuable training to individuals and organizations.

Hacked Reality is designed to be both entertaining and educational, with a range of features that make it an ideal training tool for the cyber security industry. By simulating real-life scenarios and challenging players to make the right decisions, this game will help to develop the skills needed to prevent cyber-attacks and maintain secure networks.



### Eskool

E-Skool is a personalized learning platform for children aged 3-6 that aims to enhance their learning experience by categorizing their learning styles and adapting to their needs. The app uses adaptive and categorized learning techniques through ICT and the KNN algorithm to identify the most suitable learning method for each child through game-based quiz assessments. By focusing on personalized learning through categorization, E-Skool allows children to learn and perform to their fullest potential. Compared to other educational apps, E-Skool offers a unique approach that prioritizes the individual learning styles of each child, leading to better learning outcomes. With its target group focused on English as a communication mode, E-Skool has the potential to make a significant impact on children's education worldwide. The project team participated in the Microsoft Imagine Cup and were selected as regional finalists and made it to the national





## Integrated Circuit Design (ICD), and Radio Frequency Circuits Sensors and Systems (RFCS2) Labs

are established to create a culture of innovation and then put the innovation into industrial practice as a final step. The labs are working to develop the ecosystem of the integrated circuit and RF systems design in Pakistan, which is necessary to get a fair share for Pakistan from the global RF and IC design industry of more than 500 billion US\$/year. The primary focus of these Labs is to provide the students and engineers with the industry-standard licensed tools and environment which promotes the creation of new knowledge and innovation. The labs have an active liaison with relevant national and overseas organization, and have secured industrial funding of more than 200 Million Rupees in the last two years. Apart from fundings, the group also secured in-kind support of worth more than 150,000 US\$ by contesting in international IC design competitions.

## Industrial Collaboration and Funding

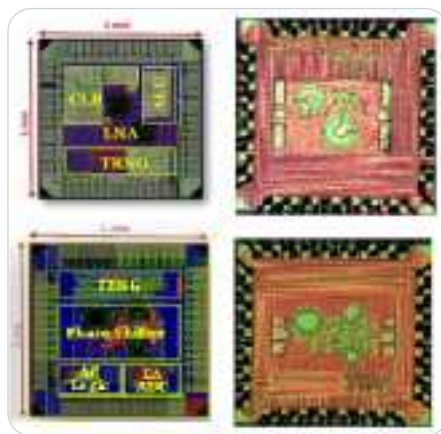
RFCS2 and ICD Labs is collaborating with various national and overseas organizations, and have secured the industrial funding of more than 200 Million Rupees in last two years for MS IC Design and Industrial Training programs.

The labs provide the rare academic opportunity for IC designing on Licensed Cadence Tool Suite and hands-on design experience on TSMC officially provided 65nm, 130nm, and 150nm CMOS process development kits (PDKs). The first graduate student batch of the FAST-NU IC design program taped out eight different projects in TSMC 65nm CMOS node. The projects covered the scope of; digital, analog, mixed-signal, and RF IC domains. The group is actively

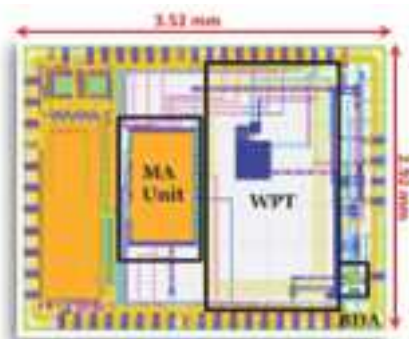
participating in international IC design contests. ICD group participated in the prestigious IEEE solid-state circuit society (SSCS), platform for

## Tools and Lab Facilities

The labs provide the rare academic opportunity for IC designing on Licensed Cadence Tool Suite and hands on design experience on TSMC officially provided 65nm, 130nm, 150nm, and 180nm CMOS process development kits (PDKs).



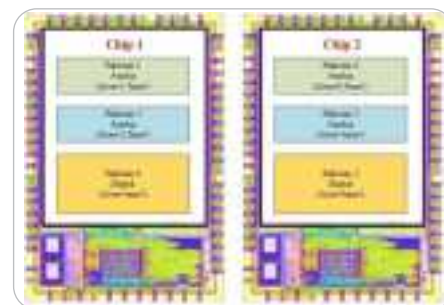
IC design outreach (PICO) program. The participants from more than 152 countries applied for the PICO 2021 contest. PICO 2021 committee shortlisted 18 projects for final grant award, and out of those 18, three (03) projects were from FAST-NU, ICD group. The students from second batch of the MS EE Specialization in



ICD participated in PICO 2022, and got final grant award for seven (07) projects out of total of twenty-two (22) selected projects for PICO 2022 award. In PICO 2023 ICD Lab got the award grant for six (06) project out of total

count of thirteen (13) globally. ICD group is the only one globally, that secured project grant awards in each all PICO contests yet. The tapeout and packaging cost of the projects is sponsored by the SSCS, which is around 10,000 US\$ per project.

**IEEE SSCS PICO Design Contest**  
ICD Lab secured seven (out of 22 globally selected), and six (out of 13 globally selected) tapeout projects funding award in IEEE SSCS PICO design contest 2022 and 2023 respectively



## IC Design Tapeout

The first graduate student batch of FAST-NU IC design program taped out eight projects in TSMC 65nm CMOS node, and three projects in SkyWater 130nm CMOS node. The second batch taped-out seven projects in SkyWater 130nm pdk.

ICD group is actively collaborating with local and international relevant organizations. First graduate batch of MS EE with specialization in IC design is fully sponsored and hired by a public sector organization. Second batch completely hired by public and private sector organizations before the completion of second semester. The third batch of the program is partly sponsored by GMSE-USA (A Silicon Valley Company), which is offering fellowship to 60% students of batch-3, covering student's university expenses, and monthly stipend. Keeping in view the high market demand, the program is tailored in such a way that the students are ready to enter market after completion of two semesters. Detail of program can be found at <http://isb.nu.edu.pk/rfcs2/MS.htm>.

ICD Lab is also collaborating with GSME\_Oman in establishing first IC Design Centre in Oman. The ICD group is leading the activities of 10 months Advanced IC Design Training for 100 Omani Engineers. The training is first of its kind venture in entire Gulf region, and received huge appreciation in Middle East Semiconductor Summit 2023. GSME USA sponsored 20 MS ICD fellows in Fall-2022, and now establishing its first design centre in Pakistan at FAST Headquarter. In addition to it, ICD Lab in collaboration with other overseas partners like, OpenSource FPGA Foundation, Radip Silicon, etc., and have conducted several international ICD workshops since 2021.

The labs have several high impact IEEE journal papers, international patents, and real world working ICs to its credit. In year 2022 the lab secured the grant of one HEC-NRPU, and an HEC-CPEC-CRG project. two HEC



### ICD\_Lab – GSME Collaboration

The ICD lab is conducting the 10 months Advanced IC Design Training for 100 Omani Engineers for GSME-Oman IC Design centre. GSME USA sponsored 20 MS ICD fellows in Fall-2022, and now establishing its first design centre in Pakistan at FAST Headquarter.

projects, NRPU and CPEC-CRG program Both labs are equipped with all basic instruments like RF sources, Spectrum and Vector Network Analyzer (VNA) and PCB milling machine. The labs have developed local and international academic and industrial collaboration, in order to provide feasible, real-time and cost-effective industrial solutions.

### Areas of Expertise:

- RF Circuit and System Design
- Microwave Sensors and Systems
- GHz Energy Tunnelling and its Applications
- Ultra-Low Power Bio Medical Sensors
- IoT Devices and Sensors
- Self-Powered Energy Harvesting
- Special Expertise for BiST and DfT
- Switched Capacitor Integrated Circuits
- Mixed Signal Integrated Circuits

### Local Partners & Collaborations:

- National Engineering and Scientific Commission (NESCOM)
- INNEXIV, Pakistan
- Pakistan Aeronautical Complex, Kamra
- NRTC. Haripur
- 10x Engineering, Lahore
- AQL Technologies, Islamabad
- Impare, Islamabad

### International Partners & Collaborations:

- GSME-Oman
- GSME-USA
- OSFPGA, USA
- Rapid Silicon, USA
- University of Waterloo, Canada
- United Arab Emirates University, UAE
- Taibah University, Medina, Saudi Arabia
- Sungkyunkwan University, South Korea
- Ajou University, South Korea
- Abu Dhabi University, UAE

### Recent Projects:

**Low Power Temperature Sensor for Vaccines** is designed which consists of temperature sensor, rectifier, and regulation blocks. The sensor has been fabricated in CMOS process on

RFCS2 and ICD labs have highly competent and experienced team of researcher and engineers.

area of 1.5mm x 1.5mm. Testing results shows the temperature sensor is ultra-low powered (100 nW) and has an accuracy of 0.2°C. Such type of temperature sensing IC can be used in the vaccine and medicine vials for continuous monitoring of the vaccine's temperature.

**All Electronic Fuel Impurity Sensor** is based on the recently reported phenomena of energy tunneling. Therefore, the basic idea behind contamination detection is unique and new. The proposed sensor is low power, rugged, simple and highly sensitive; it can detect a minor change in the dielectric constant of the fuel. The operational power requirements of the sensor are extremely low. Self-calibrated is needed to tackle the effect of temperature variations.

**Plant Water & Moisture Sensor** works on the phenomenon of phase dispersion. This is accurate and stable in noisy environments, work for real leaf and foliage samples. The technique is very simple yet very effective, it detects the permittivity of water inside the sample. The proposed sensors are selfpowered and more sensitive and stable compared to the sensors available in the market sensors. These sensors have a huge market in agriculture related autonomous irrigation systems.

**Power Amplifier** The group is involved in the PAs design for the industrial application meeting the tough temperature and environmental requirement. Recently, we designed the 100W 1.2 to 1.6GHz Class-E PA for industrial applications. We have also done Class-AB PAs for L & S band for linear applications including the pre-driver, power supply and OV, OC, and OT protections circuits.

### Team Members and Alumni:

- Prof. Dr. Rashad Ramzan
- Dr. Hassan Saif
- Engr. Hamza Atiq
- Engr. Aqsa Ehsan
- Eng. Ali Sabir
- Engr. Faizan Khan
- 42 Graduate Students
- 23 Graduate Student Alumni

### Recent Selected Journal Publications

1. M. Amin, O. Siddiqui, H. Abutarboush, M. Farhat, R. Ramzan, "A THz Graphene Metasurface for Polarization Selective Virus Sensing", Journal of Carbon, DOI:10.1016/j.carbon.2021.02.051 Volume 176, Pages 580-591, ISSN 0008-6223, 13 Feb, 2021. (JCR IF 8.01)
2. Q. Navid, A. Hassan, A. Fardoun, R. Ramzan, A. Alraeesi, "A. Fault Diagnostic Methodologies for Utility-Scale Photovoltaic Power Plants: A State of the Art Review". MDPI Journal, Sustainability, DOI: 10.3390/su13041629, Issue 13, Page. 1629, 03 Feb, 2021. (JCR IF 2.78)
3. A. Jabbar, R. Ramzan, O. Siddiqui, M. Amin, F.A.Tahir "Wave Discrimination at C-band Frequencies in Microstrip Structures Inspired by Electromagnetically Induced Transparency", Nature Scientific Reports, DOI: 10.1038/s41598-021-82618-1, Issue 11, Page. 2983, 03 Feb, 2021. (JCR IF 5.28)
4. R. Ramzan, M. Omar, O. Siddiqui, T. Ksiksi and N. Bastaki, "Internet of Trees (IoTr) Implemented by Highly Dispersive Electromagnetic Sensors," in IEEE Sensors Journal, doi: 10.1109/JSEN.2020.3014387, vol. 21, no. 1, pp. 642-650, 01 Jan, 2021. (JCR IF 2.617)
5. R. Kraim, A. Iftikhar, R. Ramzan, "Performance Issues-Mitigation-Techniques for On-Chip Antennas -- Recent Developments in RF, MMWave, and THz Bands with Future Directions",

IEEE Access, DOI: 10.1109/ACCESS.2020.3042928; Vol. 8, Page. 219577, 17 Dec, 2020. (JCR IF 3.557)

6. Q. Navid, A. Hassan, A. Fardoun, R. Ramzan, "An Online Novel Two-Layered Photovoltaic Fault Monitoring Technique Based Upon the Thermal Signatures", DOI: 10.3390/su12229607. Vol.12, Issue 22, Page. 9607 MDPI Journal, Sustainability, 18 Nov, 2020. (JCR IF 2.78)
7. J. Yousaf, W. Nah, E. R. Al Majali, H. Saif, H. Rmili, "Rapid characterization of efficient system level ESD protection strategy using coupling transfer function", Microelectronics Journal, Volume 110, 2021. (JCR I.F 1.405)
8. M.B. Khan, D. H. Kim, J. H. Han, H. Saif, et al. "A Harvesting Circuit for Flexible Thin Film Piezoelectric Generator Achieving 562% Energy Extraction Improvement with Load Screening", IEEE Trans. Industrial Electronics, (Early Access), 2020. (JCR I.F 7.515)

### Lab Home Page:

<http://isb.nu.edu.pk/rfcs2>



### Management Advancement Research Centre - MARC



The Management Advancement Research Centre (MARC) was established at FAST\_NUCES Islamabad to conduct leading edge research in management sciences with the aim to enhance knowledge and find solutions for industry challenges. Various Special Interest Groups (SIGs) work under MARC, all committed to taking up projects

which contribute to the body of knowledge, yet at the same time provide a bridge between academia and practice.

### Current Funded Projects:

Nation-building through supporting females: Reducing organizational and individual challenges to enhance careersuccess.

**Funding Agency-HEC.** Project Code NRPU-15351.

Principal Investigator: Dr. Sadia Nadeem.

Co-PI: Ms. Ayesha Bano.

### Current International Projects:

**GLOBE 2020:** Collaboration with Simon Fraser University, Canada, and Thunderbird Business School, Arizona State University, US, in an international project to understand and compare the Pakistani culture and leadership behaviours with 140 countries across the world.

**IESE JELER Study:** Collaboration with IESE Business School, Barcelona, Spain, for a 25 country study to understand how leaders, and the trust that subordinates have in their leaders, impact employee commitment to the job and the organization, and how these relationships vary between different countries.

### Past Projects

**Pakistanis in Chinese Organisations (Funding Agency-HEC),** Project Code NRPU-10188.

Principal Investigator: Dr. Sadia Nadeem.

**Impact of Business Education on Students' Values (Funding Agency-HEC-NRPU),** Project Code NRPU 4812.

Principal Investigator: Dr. Muhammad Abbas.

**The Management Advancement and Planning Study (MAPS),** Project Code NRPU 3457, Principal Investigator: Dr. Sadia Nadeem.

**Management in Pakistani Culture (MiPC),** Project Code TRGP-III/954, Principal Investigator: Dr. Sadia Nadeem.

**GLOBE Study:** A collaboration with Thunderbird Business School, University of Arizona, USA