2023 IEEE International Symposium on Smart Electronic Systems (iSES 2023)

Ahmedabad, India 18-20 December 2023



IEEE Catalog Number: CFP23C48-POD **ISBN:**

979-8-3503-8325-6

Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

*** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

CFP23C48-POD
979-8-3503-8325-6
979-8-3503-8324-9
2832-3610

Additional Copies of This Publication Are Available From:

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400 Fax: (845) 758-2633 E-mail: curran@proceedings.com Web: www.proceedings.com



2023 IEEE International Symposium on Smart Electronic Systems (iSES) **iSES 2023**

Table of Contents

Message from the General Chairs	xvi
Message from the Technical Program Chairs	xvii
Organizing Committee	xix
Program Committee	xxi
Steering Committee	xxvi
Keynotes	xxvii
Tutorials	xxxv

Invited Papers

Automated Polynomial Formal Verification: Human-Readable Proof Generation	1
Rolf Drechsler (University of Bremen, Germany; Cyber-Physical Systems,	
DFKI GmbH, Germany) and Martha Schnieber (University of Bremen,	
Germany; Cyber-Physical Systems, DFKI GmbH, Germany)	

A	Neural Network-Based Approach to Dynamic Core Morphing for AMPs	4
	Chandra Sekhar Mummidi (University of Massachusetts Amherst, USA) and	
	Sandip Kundu (University of Massachusetts Amherst, USA)	

AIR-1: Hardware/Software for AI, Robotics, and Automation (AIR) - 1

Pāninis's Grammar as Computer Language: A Case Study
Drone Landing on Moving UGV Platform with Reinforcement Learning Based Offsets
Drone Based Potholes Detection using Machine Learning on Various Edge AI Devices in Real-Time
Motor Bearing Fault Classification using Laser Sensor and Light Weight CNN

ERS-1: Energy-Efficient, Reliable VLSI Systems (ERS) - 1

7nm Complex Networking ASIC Test Coverage Improvement by COBST (Control Point Observe Point-Based Structural Testing)
Design of Low Power ALU for RISC-V ISA
IR Drop Mitigation Methodologies in 90nm Technology Node for Networking Chip
Metaheuristic Approach for Bearing Fault Prediction

IoT-1: Hardware/Software for Internet of Things and Consumer Electronics (IoT) - 1

A Fall Detection System Using Hybrid Inertial and Physiological Signal Classifiers for Dynamic Environments Tamonash Bhattacharyya (Indian Institute of Engineering Science and Technology, India) and Prasun Ghosal (Indian Institute of Engineering Science and Technology, India)	51
IoT Intrusion Detection: Evaluating ML-Based IDS on Image and Network Traffic Datasets Manan Pathak (Charotar University of Science and Technology, India), Anuj Patel (Charotar University of Science and Technology, India), and Bela Shah (Charotar University of Science and Technology, India)	57
VitalSense+: A Mobility-Based Multi-Sink Approach for Prioritized Vital Monitoring in Military Operations Anurag G (PES University, India), Aditya Poddar (PES University, India), and Animesh Giri (PES University, India)	63
Unstructured Pruning for Multi-layer Perceptrons with Tanh Activation Lakshmi Kavya Kalyanam (University of South Florida, Tampa) and Srinivas Katkoori (University of South Florida, Tampa)	69
Effect of the Dual Attention Suppression Attack on the Performance of Self-Driving Car Models - A Preliminary Study Neil Sambhu (University of South Florida) and Srinivas Katkoori (University of South Florida)	75

NVS-1: Nanoelectronic VLSI and Sensor Systems (NVS) - 1

Cost Effective Single Target Sample Preparation on Digital Microfluidic Biochip .	
Sourav Ghosh (Supreme Knowledge Foundation Group of Institutions,	
India), Surajit Kumar Roy (Indian Institute of Engineering Science and	
Technology, India), and Chandan Giri (Indian Institute of Engineering	
Science and Technology, India)	

 Detection of Adulteration in Honey Using a Precision Analog Microcontroller Based System With an Electrochemical Sensor Interface
 Analysis of PDMS Polymeric Material for Heavy Metal Ions Sensing Application
 Temperature Sensitivity and Reliability Study of Symmetrical U-Shaped Gate Line TFET: RF/Analog and Linearity Performance Analysis
Performance Enhancement of "ARP Block" Using 28nm Technology Node

ERS-2: Energy-Efficient, Reliable VLSI Systems (ERS) - 2

A 2-Bit Multiplication Operation Using Si-SiGe-Si Channel FinFET 8T-SRAM Cell
 Optimization of Imprecise Multiplier Circuits by using Binary Decision Diagram
Area-Efficient In-Memory Computation With Improved Linearity Using Voltage-Controlled Delay Cell-Based Ring Oscillator 121 Amandeep Singh (IIT Roorkee, India) and Bishnu Prasad Das (IIT Roorkee, India)
Power Efficient Approximate Ternary Subtractor for Image Processing Applications
 Practical Analysis of Various Approaches for Targeting Delay Faults at Functional Frequency in Automatic Test Pattern Generation (ATPG)

SIP - 1: Hardware for Secure Information Processing

Low-Cost Hardware Security of Laplace Edge Detection and Embossment Filter Using HLS Based Encryption and PSO
 Key-Driven Multi-Layered Structural Obfuscation of IP Cores Using Reconfigurable Obfuscator Based Network Challenge and Switch Control Logic
Securing Fault-Detectable CNN Hardware Accelerator Against False Claim of IP Ownership Using Embedded Fingerprint as Countermeasure
 Designing Optimized and Secured Reusable Convolutional Hardware Accelerator Against IP Piracy Using Retina Biometrics
A 0.5V Energy Efficient All CMOS Temperature Sensor for IoT Applications
A High Gain Narrow Band CMOS LNA Suitable for L1 and L5 Band of Frequencies

Special Session - 1: AI in Cyber-Physical Systems

Network Intrusion Classification on the UNSW-NB15 Dataset Using XGBoost Feature Selection Technique
 Fortified-Grid 3.0: Security by Design for Smart Grid Through Hardware Security Primitives 175 <i>Giriraj Sharma (Malaviya National Institute of Technology, India),</i> <i>Amit M. Joshi (Malaviya National Institute of Technology, India), and</i> <i>Saraju P. Mohanty (University of North Texas Texas, USA)</i>
 Enhancing Privacy-Preserving Brain Tumor Detection in Medical Cyber-Physical Systems Through Deep Learning Algorithms
CRNN-Based UAV Detection Using Acoustic Signature

Lightweight Secured Split Test Technique with RMA Capability to Prevent IC Counterfeiting . 191 Sudeendra Kumar K (PES University, India), S. S. Rekha (PES University, India), Akshay Koushik (PES University, India), Ayas Kanta Swain (NIT, India), and K. K. Mahapatra (NIT, India)

Special Session - 2: Efficient Chip Design for Emerging Applications

Special Session - 3: IoT for Smart Villages

 HIdentifier: A Method in Agriculture CPS Framework to Automatically Identify Disease Hotspots Using Message Passing in Graph Kiran K. Kethineni (University of North Texas, USA), Saraju P. Mohanty (University of North Texas, USA), and Elias Kougianos (University of North Texas, USA) 	. 212
Drone Vision Based Abiotic Stress Monitoring for Smart Agriculture Sai Sriram Gonthina (IIIT Naya Raipur, India), Aditya S V S (IIIT Naya Raipur, India), Akshar Teja Gannoju (IIIT Naya Raipur, India), Venkanna Uduthalapally (IIITDM Kurnool, India), and Debanjan Das (IIIT Naya Raipur, India)	218
Acoustic Based Chicken Health Monitoring in Smart Poultry Farms Abhinay Bhandekar (IIIT Naya Raipur, India), Venkanna Udutalapally (IIITDM Kurnool, India), and Debanjan Das (IIIT Naya Raipur, India)	. 224
A Real-Time Web-Based Application for Automated Plant Disease Classification Using Deep Learning Priyanshu Pandey (Sant Longowal Institute of Engineering and Technology, India) and Rusha Patra (Indian Institute of Information Technology, India)	. 230
A Cortex M0 SoC Based IoT Platform for Agricultural Applications Amritansh Singh (IIIT Kottayam, India), Tarun Sharma (IIIT Delhi, India), Deepank Grover (IIIT Delhi, India), Keshav Goel (IIIT Delhi, India), and Sujay Deb (IIIT Delhi, India)	236

Special Session - 4: Synthesis, Analysis and Verification of In-Memory Computing Designs using Memristors

An Analysis of Fault Diagnosis Approaches in Memristor Crossbar Array	242
Dev Narayan Yadav (Siksha 'O' Anusandhan, India), Phrangboklang	
Lyngton Thangkhiew (Indian Institute of Information Technology,	
India), and Indranil Sengupta (Indian Institute of Technology, India)	

In-Memory Machine Learning Using Hybrid Decision Trees and Memristor Crossbars	248
Akash Chavan (Oakland University, USA), Pranav Sinha (Oakland	
University, USA), and Sunny Raj (Oakland University, USA)	
Memristors: Device Modeling, Design and Verification	. 254
Kamalika Datta (Cyber-Physical Systems, DFKI GmbH, Germany; University	
of Bremen, Germany) and Rolf Drechsler (Cyber-Physical Systems, DFKI	
GmbH, Germany; University of Bremen, Germany)	

AIR-2: Hardware/Software for AI, Robotics, and Automation (AIR) - 2

Detecting Forged Facial Videos Using Convolutional Neural Networks	0
Cross-Layer Age-Aware Scheme for Highly Reliable Memristive AI Accelerator Design	5
 Approximate CNN on FPGA Using Toom-Cook Multiplier	'1

ERS-3: Energy-Efficient, Reliable VLSI Systems (ERS) - 3

Huffman Cache Trails	
 Design and Analysis of Low-Voltage, MOS-Only Bandgap Reference Circuit	
 Approximate Three-Operand Binary Adder for Error-Resilient Applications	
Design & Implementation of Novel Asynchronous FIFO	

IoT 2: Hardware/Software for Internet of Things and Consumer Electronics (IoT) - 2

QPUF: Quantum Physical Unclonable Functions for Security-by-Design of Industrial Internet-of-Things	296
Venkata K. V. V. Bathalapalli (University of North Texas), Saraju P. Mohanty (University of North Texas), Chenyun Pan (University of Texas at Arlington), and Elias Kougianos (University of North Texas)	
IoT-Based Smart Dustbin for Effective Waste Management Harsh Panara (Nirma University, India), Neel Patel (Nirma University, India), Trushti Selarka (Nirma University, India), and Amisha Naik (Nirma University, India)	302
FPGA Implementation of Modified Lightweight 128-Bit AES Algorithm for IoT Application Jeyvarshni Vimalkumar (NIT Trichy, India), Harshitha Ramesh Babu (NIT	s 306

Trichy, India), and Bhaskar M (NIT Trichy, India)

VIS-NVS: Vehicle Intelligent Systems/Nanoelectronic VLSI and Sensor Systems

Low Power and Area-Efficient Hybrid Adder for ALU Operation
Security Evaluation of Lightweight SBoxes
A Novel Scheme Based on Optimization for Controlling the Speed of PMBLDC Motor

of Science Education & Research Bhopal, India)

Special Session – 5: AI in Cyber-Physical Systems

 Improved Target Tracking and Fusion Using Optimally Quantized Measurement Channels 323
 Balarami Reddy B N (National Institute of Technology Karnataka (NIT-K), India), Harinatha Reddy G (NBKRIST Vidyanagar, India), Sreenivasula Reddy T (ECE Sri Venkateswara University, India), Srihari Pathipati (National Institute of Technology Karnataka (NIT-K), India), and Pardhasaradhi Bethi (Continental Autonomous Mobility India Pot. Ltd, India)

 FPGA Accelerated Track to Track Association and Fusion for ADAS Distributed Sensors 329 Gopala Swamy B (Qualcomm India Private Limited, India), Harinatha Reddy G (NBKRIST Vidyanagar, India), Srihari Pathipati (National Institute of Technology Karnataka, India), Shripathi Acharya U (National Institute of Technology Karnataka, India), and Pardhasaradhi Bethi (Continental Autonomous Mobility India Pot Ltd., India) 	
 Evaluating the Effectiveness of PRNU-Based Forensic Techniques in Mobile Devices Using Peak Correlation Coefficient	
MTI Filter DSP Architectures in FMCW Radar Framework for ADAS Applications	

Special Session – 6: Smart Technologies

Asana Uplift: Elevating Yoga Practice With Deep Learning and Raspberry Pi 4 Sakshi Sakshi (The LNM Institute of Information Technology, India) and Sandeep Saini (The LNM Institute of Information Technology, India)	347
Forti-Ins: A Blockchain Based Framework to Automate Healthcare Insurance Processing in Smart Cities	353
Musharraf N. Alruwaill (University of North Texas, USA), Saraju P. Mohanty (University of North Texas, USA), and Elias Kougianos (University of North Texas, USA)	
Improved Human Activity Recognition Technique with Multi-Class Support Vector Machine .: Vipra Bohara (Rajasthan Technical University, India) and Amit Joshi (Malaviya National Institute of Technology, India)	359
Real-Time Castor Leaf Disease Detection Using Machine Learning on Edge AI Device	365

India), and Nagendra Gajjar (Nirma University, India)

Regular Track - Student Research Forum (SRF)

FruitPAL: A Smart Healthcare Framework for Automatic Detection of Fruit Allergens	369
Abdulrahman Alkinani (University of North Texas, USA), Alakananda	
Mitra (University of Nebraska-Lincoln, USA), Saraju P. Mohanty	
(University of North Texas, USA), and Elias Kougianos (University of	
North Texas, USA)	

Design, Development and Testing of Electronic Control Unit Prototype in an Electric Vehicle 377 Riththika Sukanandan (Electronics and Communication Engineering 377 Institute of Technology, Nirma University, Ahmedabad, India) and 378 Sachin Gajjar (Electronics and Communication Engineering Institute of 76 Technology, Nirma University, Ahmedabad, India) 77
 Design of Low Noise, High Sensitive Front End Electronics for the Charge Readout from Silicon Photomultiplier Detector for Future Space Exploration Programs
Real Time Voice Recognition System using TinyML on Arduino Nano 33 BLE
Incorporating Visual Intelligence in Line Following Robots

LBR-1: Late Breaking Research - 1

Assist Techniques for Radiation Hardened SRAM in Space Applications
Power Budget Improvement Using Floorplan Methodologies in Lower(28nm) Technology Node 397
Vidhi Gandhi (Ganpat University, India), Yashvi Patel (Ganpat University, India), and Bhavesh Soni (Ganpat University, India)
Domino Logic Based Noise Immune Schmitt Trigger Circuit
Accelerating Sorting Performance on FPGA: Combining Quick Sort and Heap Sort Through Hybrid Pipelining
A Memory Efficient Run-Time Re-Configurable Convolution IP Core for Deep Neural Networks Inference on FPGA Devices

LBR-2: Late Breaking Research - 2

iTMS: Development of IoT Based Low-Cost Storage Parameters Monitoring System for Tomato 417

Tanmay H. Bhatt (Anand Agricultural University, India) and Vishal I Mehra (Anand Agricultural University, India)

IoT and ML Based Smart Pill Dispenser (SPD) Application for Monitoring Elderly People 421 Vindhya Avvari (University of Southern California, USA), Sugandha Yarlagadda (Vellore Institute of Technology, India), Pardhasaradhi Bethi (Continental Autonomous Mobility India Pvt. Ltd, India), Praneetha Sree R. (Indian Institute of Information Technology, Design, and Manufacturing, Kurnool), and Vishnu Srinivasa Murthy Yarlagadda (Manipal Institute of Technology Bengaluru, Manipal Academy of Higher Education, Manipal)

A Hybrid Approach Using ARIMA, Kalman Filter and LSTM for Accurate Wind Speed Forecasting

Regular Track - RDS-1: Research Demo Session

Lite-Agro 2.0: Integrating Federated and TinyML in Pear Disease Classification IoAT-Edge AI
 W-DaM: Weather Data Management in Smart Agriculture Using Blockchain-as-a-Service 433 Sukrutha L. T. Vangipuram (University of North Texas, USA), Saraju P. Mohanty (University of North Texas, USA), and Elias Kougianos (University of North Texas, USA)
Smart Non-Invasive Real-Time Health Monitoring Using Machine Learning and IoT
Integrated IoT-Based Air Quality Monitoring and Prediction System: A Hybrid Approach 441 Lopamudra Samal (National Institute of Technology Rourkela), Aryan Samal (National Institute of Technology Rourkela), Ayas Kanta Swain (National Institute of Technology Rourkela), and KamalaKanta Mahapatra

(National Institute of Technology Rourkela)

Enhanced Smart Stick Design for Visually Impaired	445
Dhyanik Pujara (Nirma University, India), Riya Gautam (Nirma	
University, India), Burhanuddin Sabuwala (Nirma University, India),	
and Dhaval Shah (Nirma University, India)	
Integrative Home Automation System - A Multifaceted Approach	. 449
Dhyanik Pujara (Nirma University, India), Riya Gautam (Nirma	
University, India), and Dhaval Shah (Nirma University, India)	
Author Index	453