

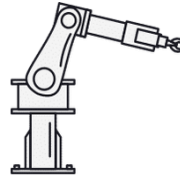
IoT Sensor Technology for Development of the Thai Society

Advancing Thai Intelligent Sensors: From Research to Market

by Assoc. Prof. Dr.-Ing. Suramate Chalermwisutkul

NECTEC Annual Conference & Exhibitions: NECTEC-ACE 2024
IMPACT Forum Muang Thong Thani

10 September 2024



Electric Vehicles

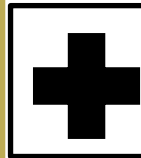
AI, ML, Data Science

Robotics

Quantum Computing

Climate Change

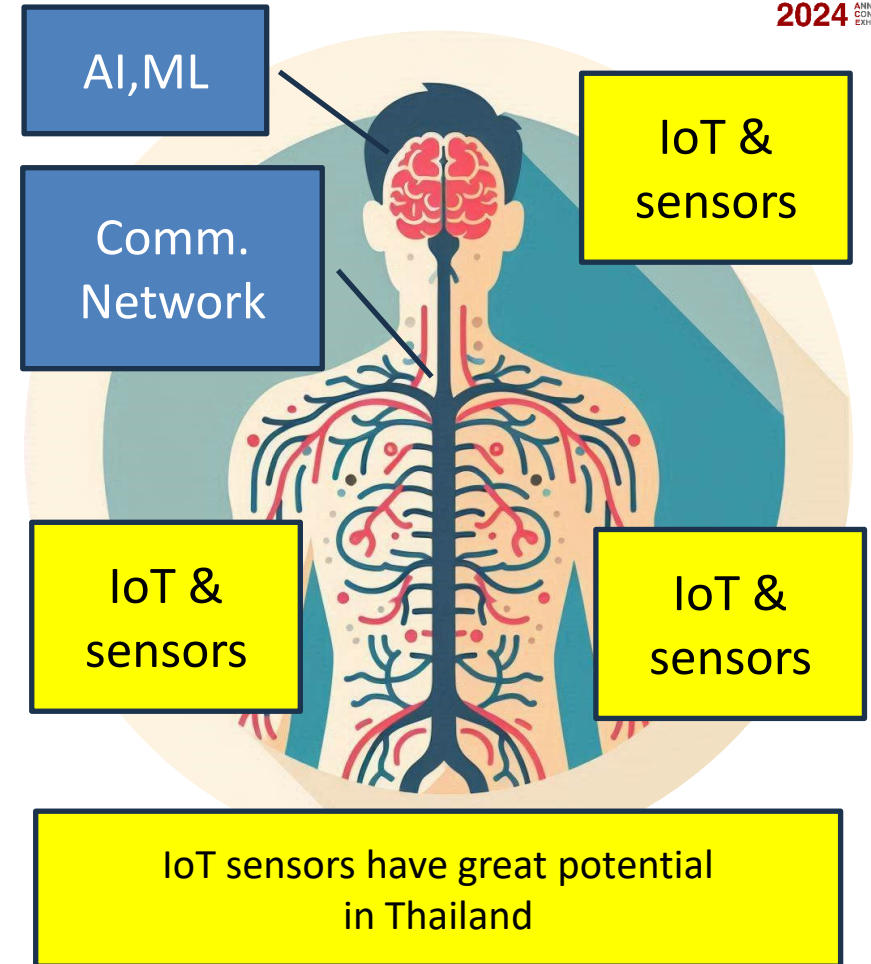
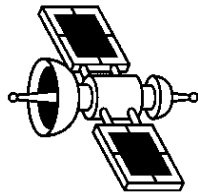
Health Tech



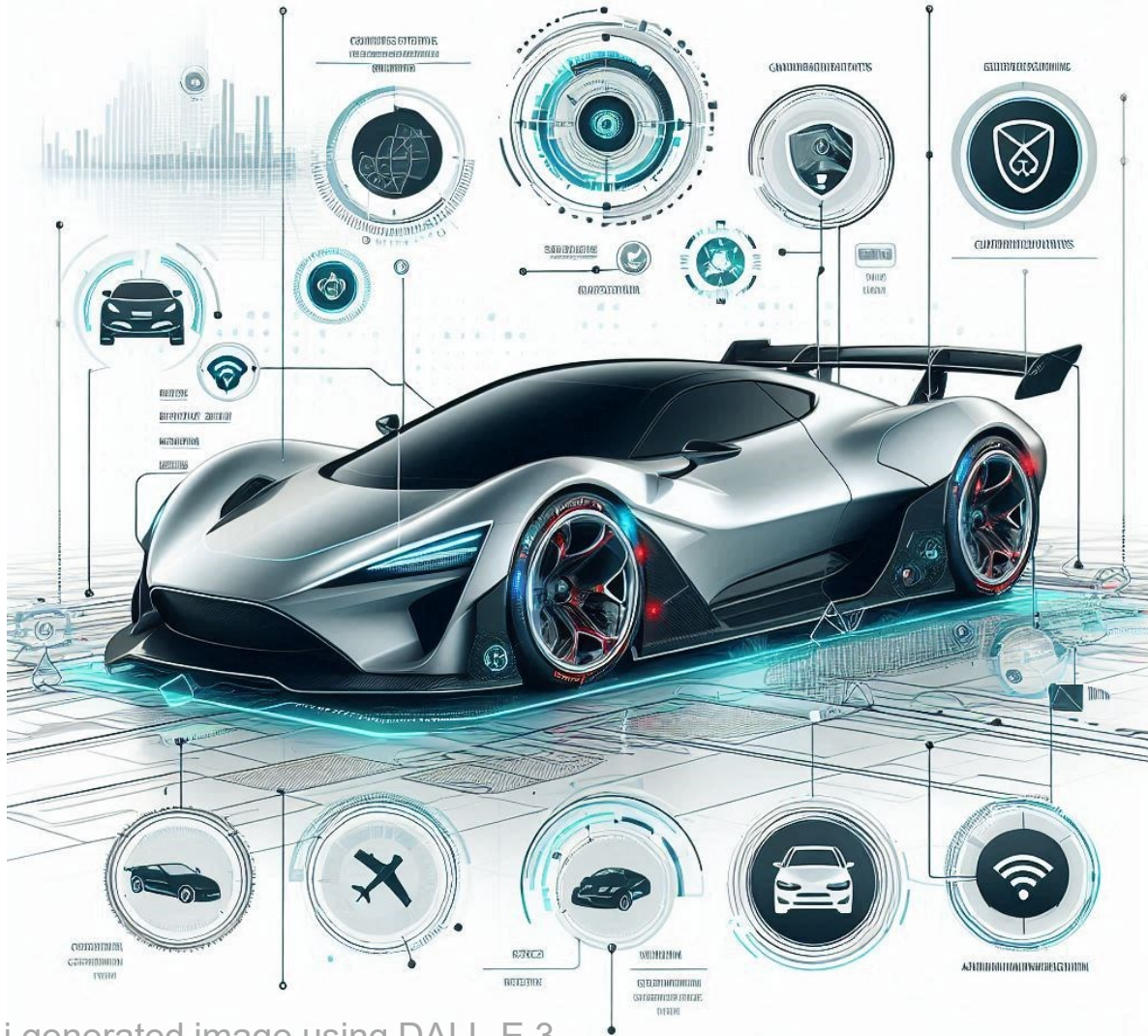
Fintech, Block Chain, Crypto

Drones, Satellites, Space Tech

Smart City Industry 4.0 Smartgrid



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Sensors in a smart car

Cameras

Versatile, high resolution

Degrade in low light or adverse weather, data-hungry

LiDAR (Light Detection and Ranging)

Creation of 3D maps, accurate distance measurement

Low-speed autonomous navigation

Affected by rain and fog, expensive

Ultrasonic

Parking Assistance, Blind Spot Detection

Low-speed Collision Avoidance

Short range and not for high-speed detection

Radars

All-weather, high-speed detection, long range

Low resolution

Devices sense their environment and communicate data over the network.
Networks sense locations and statuses of devices.

5G changed industries.

6G will change societies.

Benefits

- Efficiency, reduced cost
- Better decision making
- Higher security
- High level of automation

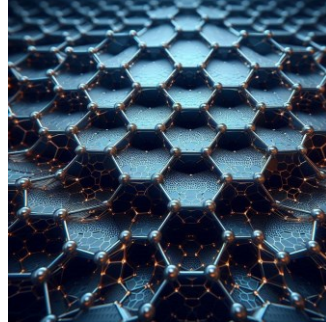
Applications

- Autonomous vehicles with improved safety and traffic flow including air taxi.
- Smart cities with optimized urban infrastructure.
- Healthcare: Wearable devices for self-care and telemedicine.
- Critical data transfer with high security including location information



Materials for sensing applications

- Graphene and other monolayers
- Nanoparticles and nanostructures
- Polymers, ceramics
- Biodegradable materials



Fabrication technology

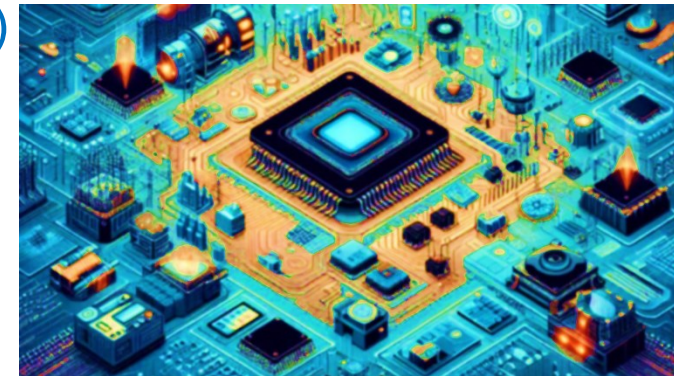
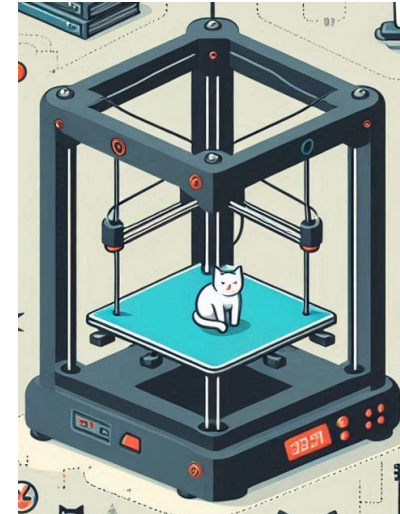
- 2D and 3D printing
- Advanced techniques like evaporation, sputtering, etc.
- Can be combined with semiconductor technology (more than Moore)

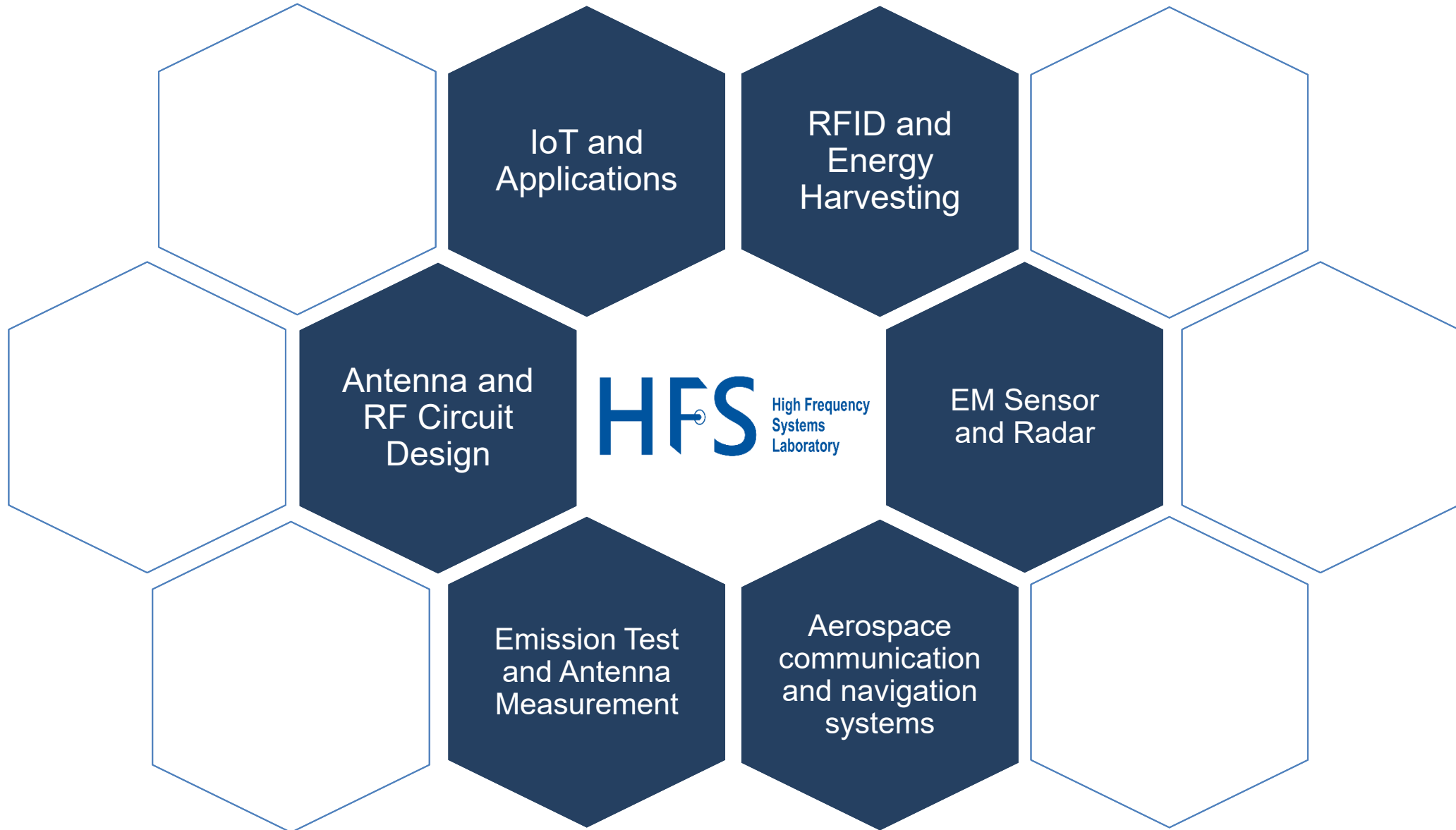
Sensing technology

- Electrochemical sensors (Chulalongkorn, VISTEC and other institutions)
- Terrahertz (NECTEC/PMUC)
- MEMs
- IsFET (Ion-sensitive field effect transistor) from TMEC
- SERS (surface-enhanced raman spectroscopy) from NECTEC

System integration

- Smart wheelchair and beds
- Rehabilitation systems and robots
- Agricultural sensors





Key Features:

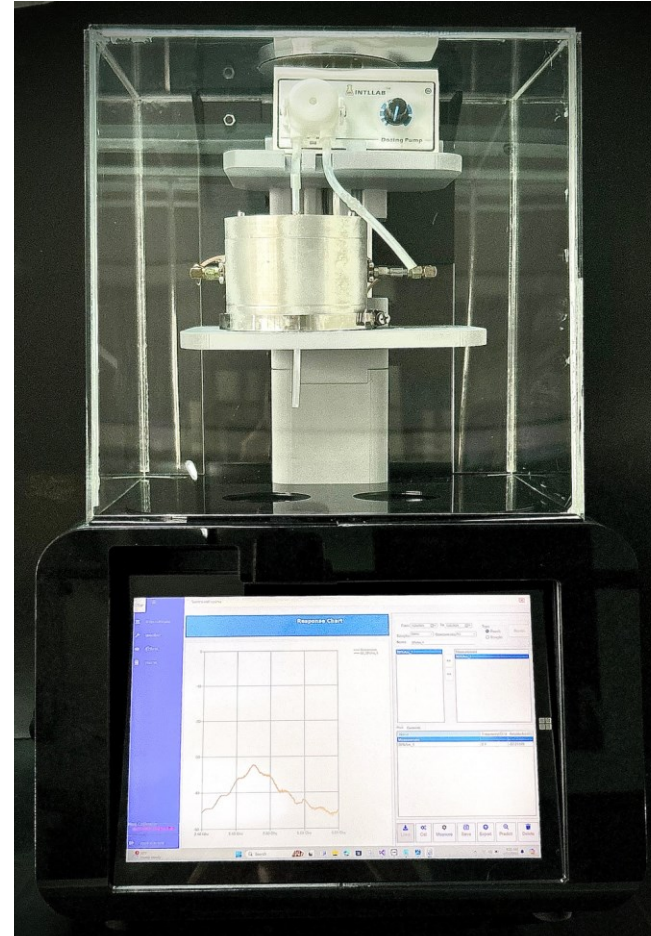
- Real-time data digitization
- Cloud storage for data interpretation using machine learning

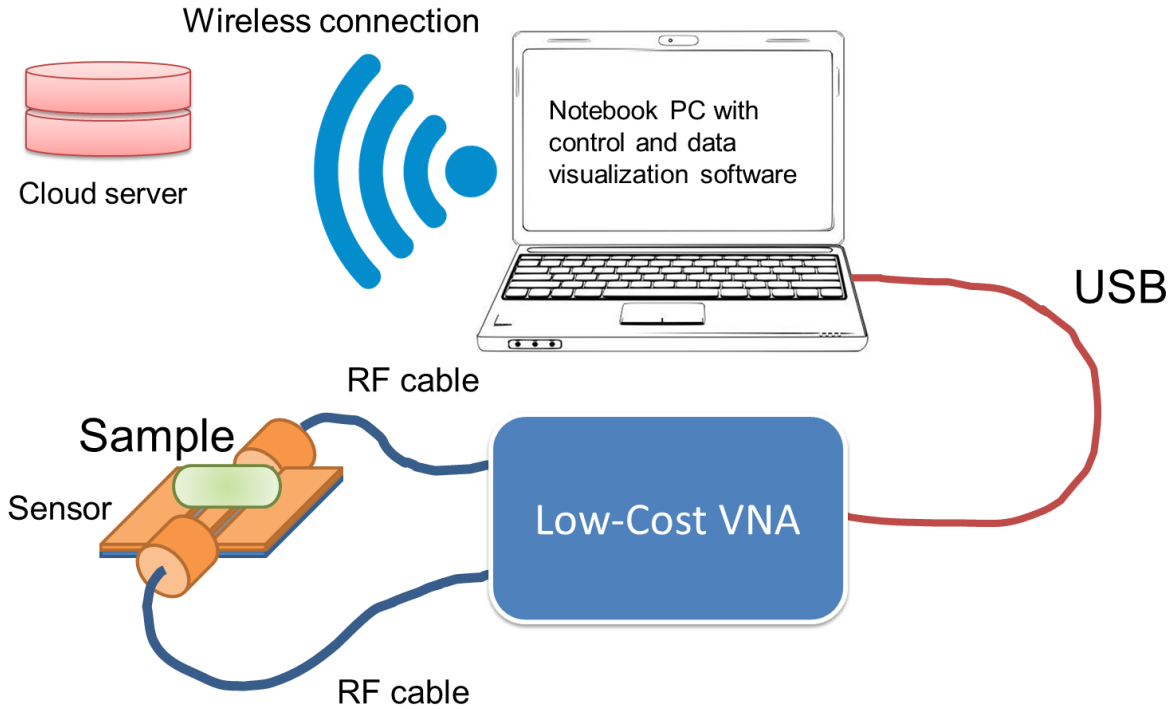
Industries Benefiting:

- Petrochemical
- Chemical
- Food
- Wastewater treatment
- Medical diagnostics
- Transformer oil quality monitoring

Patent Status: TRL7, Application filed

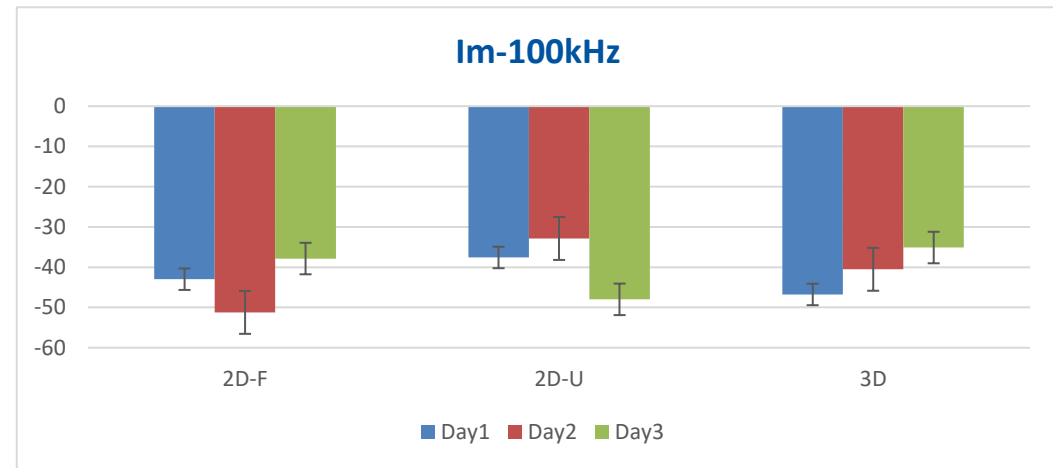
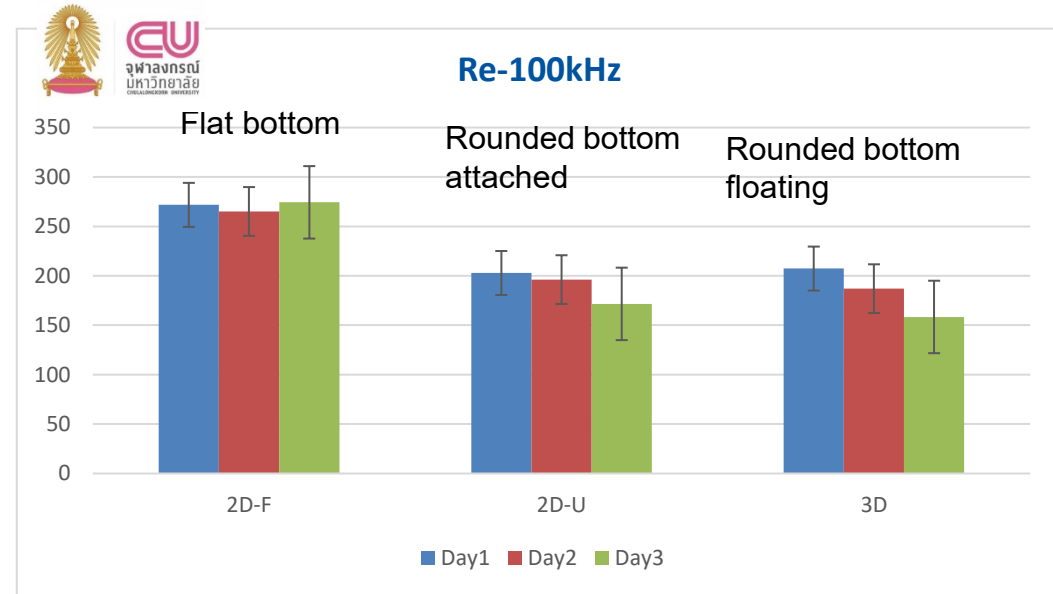
Funding: Provided by PTT Public Company Limited

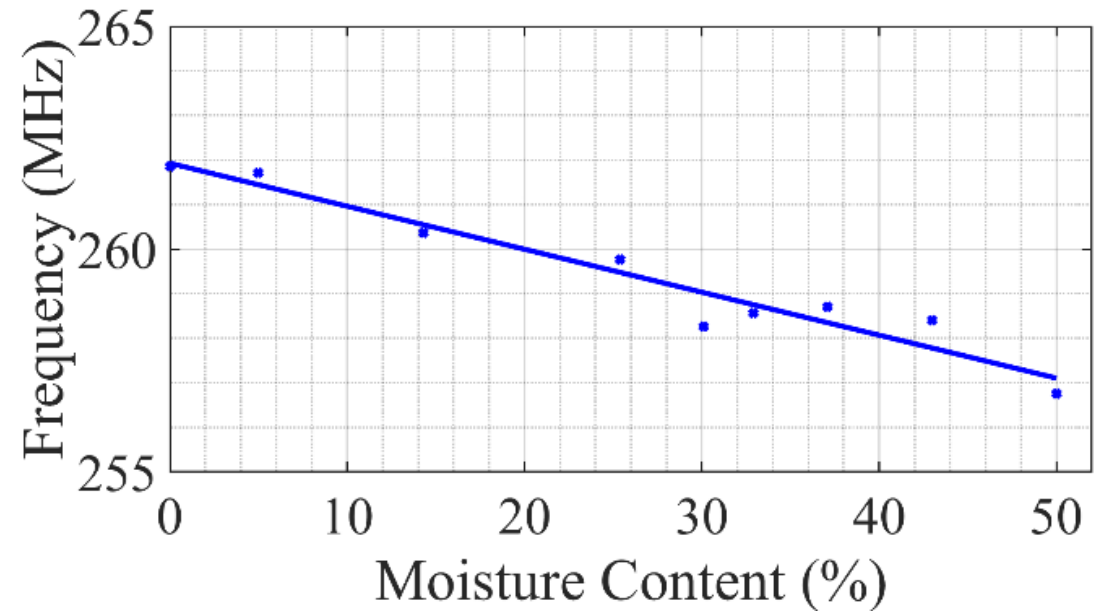
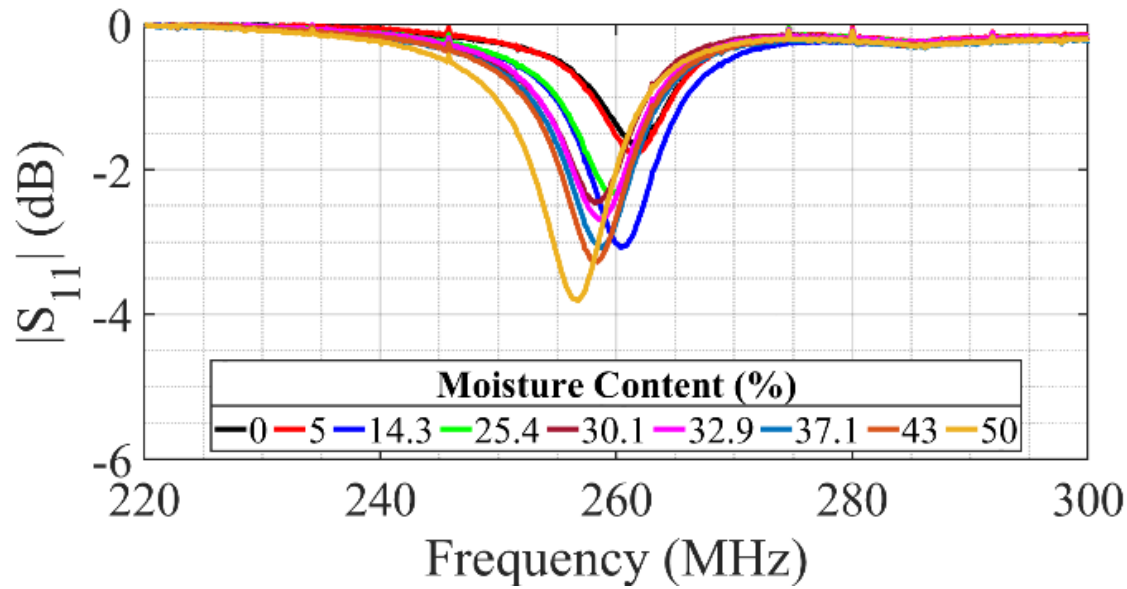


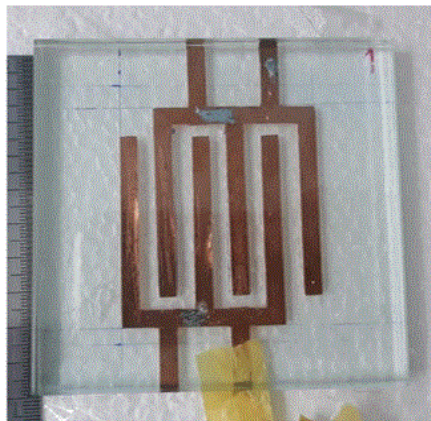
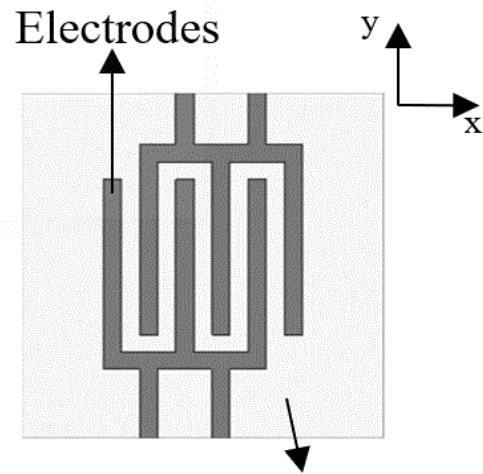
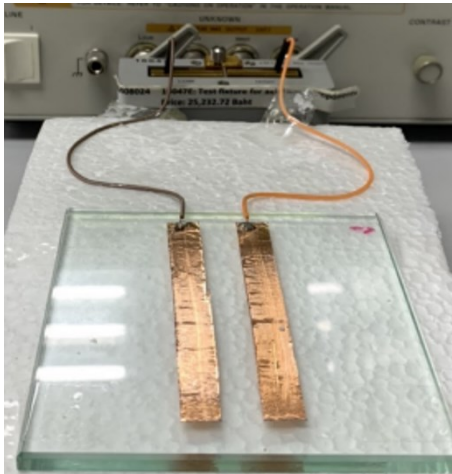
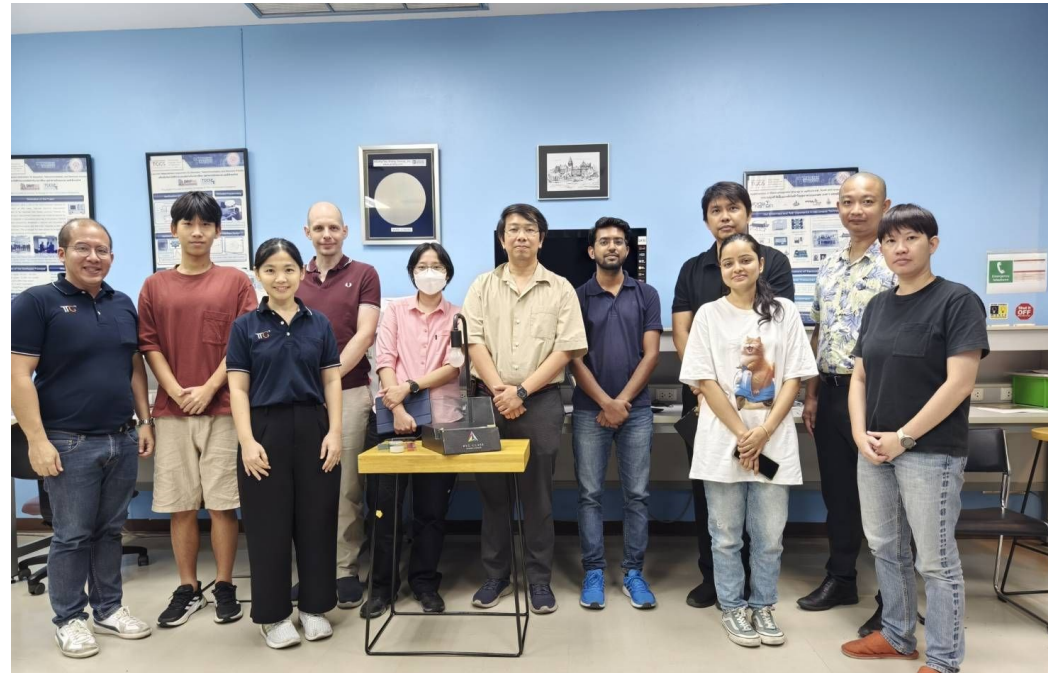
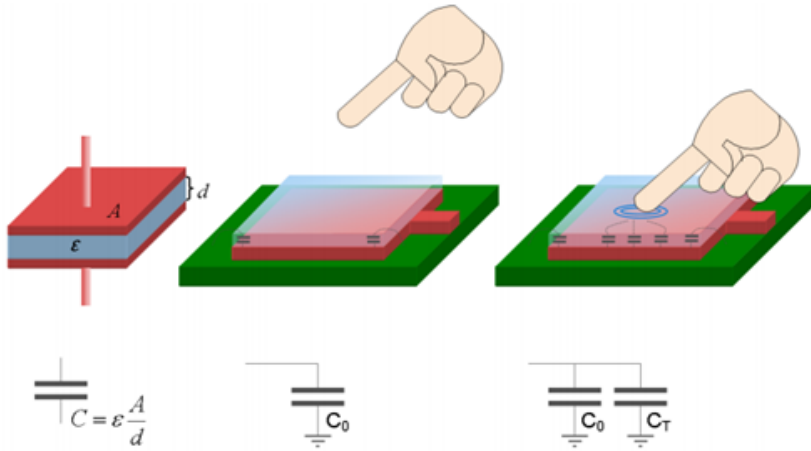


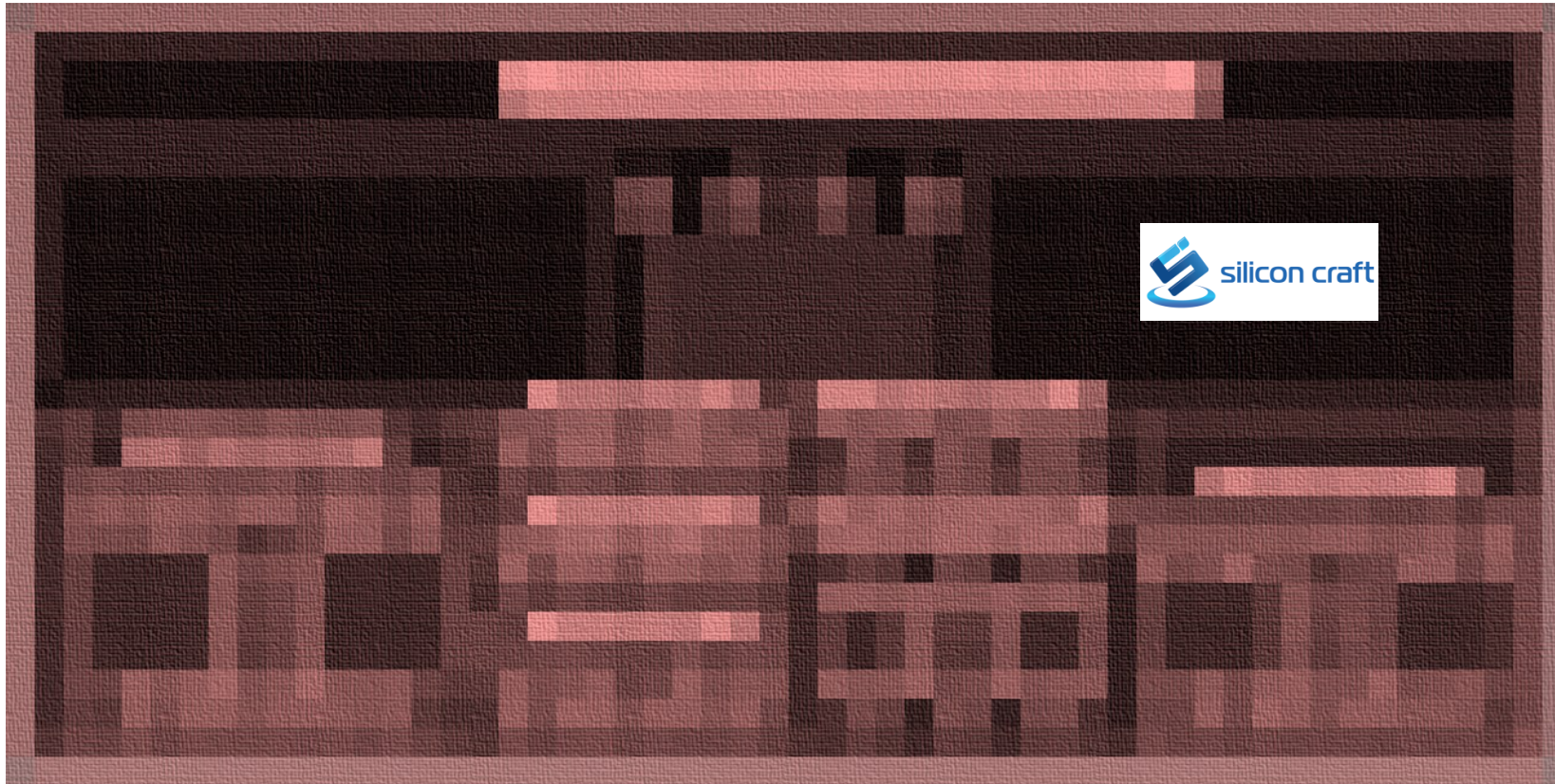
Future work

- Microfluidic sensors
- Smart cell cultures









On-chip RF rectifier circuit and loop-dipole antenna for testing with die size 2400x1200um²



- G-S-G Pad calibration (open, short, load)
- Pad with/without ESD protection circuit
- Differential and single end structure of the RF rectifier circuit
- Measure the Gain, return loss and radiation pattern of Antenna (G-S-S-G)



IoT sensor research can mitigate numerous social problems in Thailand.

- Traffic and motorcycle accidents
- Self-care for aging society
- Contaminated water, water management
- Disaster warning systems
- Air pollution
- Low-cost and accessible medical devices
- Defense technology
- Security in financial and other sectors

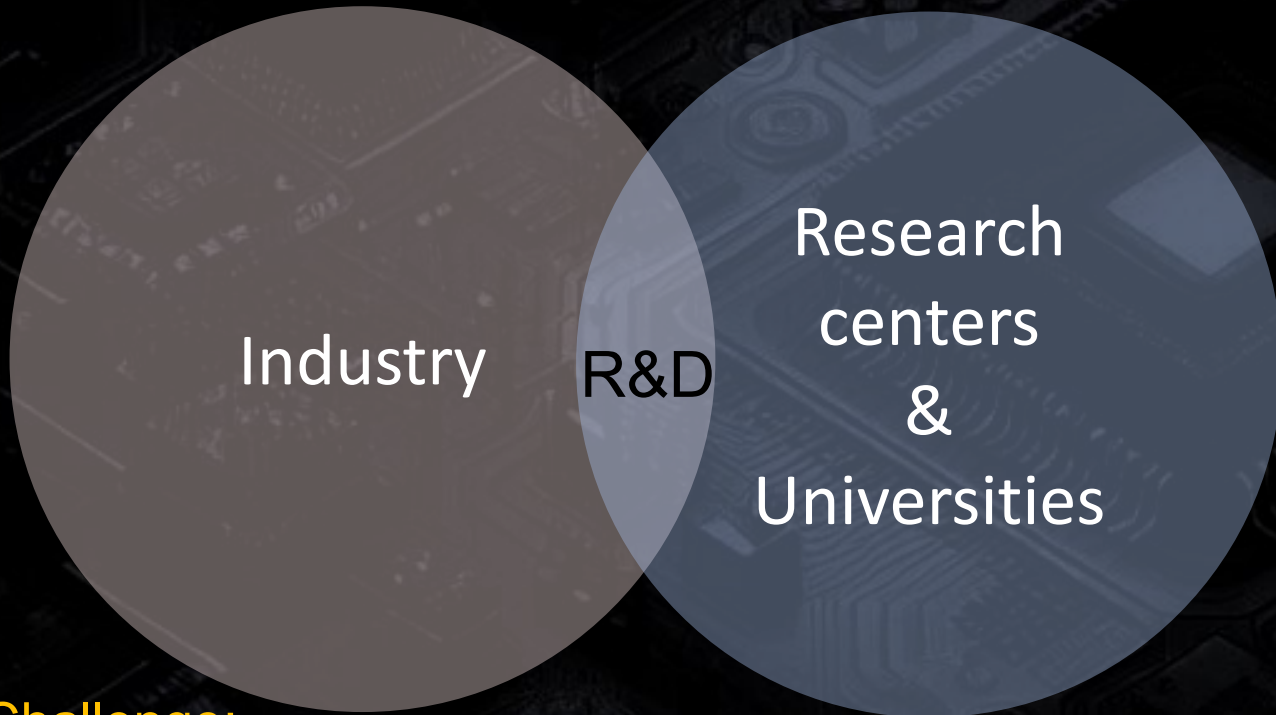


Thailand and ASEAN have specific challenges not addressed by big tech industries and nations. Do things that no one wants to do and dominate in the future (like TSMC)
→ Aim for global markets!

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Suramate Chalermwisutkul: Panel discussion on IoT Sensor Technology for Development of the Thai Society
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Reach out, connect and come out of your comfort zone before it gets uncomfortable

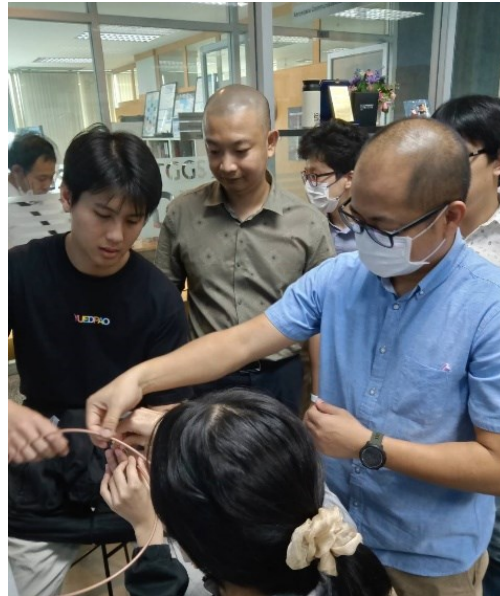


- Look for all-win situations
- Collaborate → Co-create → Co-own
- There is no “research on the shelves”.
- Combine strengths, mitigate weaknesses
- All can learn from one another.
- Professors must also learn from industrial partners.
- Respect and be fair.

Challenge:

- Thai tech ecosystem: We are small. Gather and support one another.
- Promote confidence in Thai technology, scientists, technologists, and innovators.
- Establish national-level strategies for managing contributions and benefits.
- Create Thai technological products and brands starting from small simple things.

Participants from the industry learned about line impedance control on PCBs



IRCT **KEYSIGHT**

2 DAYS SEMINAR

RF - 101 TRAINING COURSE

Introduction to Radio Frequency and Microwave Technology

Learning Outcomes

The Course Introduction to Radio Frequency and Microwave Technology (RF 101) is a fast-paced and intensive training program designed specifically for engineering professionals.

Key benefits

- ✓ Condensed overview of microwave engineering principles
 - Network Parameters
 - S-parameters
 - Smith Chart
 - Impedance Transformation
- ✓ Gain a solid foundation in RF and microwave engineering to apply in scientific work
- ✓ Hand - on training
- ✓ Certificate of completion

3rd Floor of TGGs Building
1518 Pracharat 1 Road, Wongsawang, Bangsue Bangkok 10800, Thailand

MAIN INSTRUCTOR

Assoc. Prof. Dr.-Ing. Suramate Chalermwisutkul
King Mongkut's University of Technology North Bangkok

Limited Seats!

More Information & Registration

: @Ircrt

: www.irct.co.th

SCAN ME

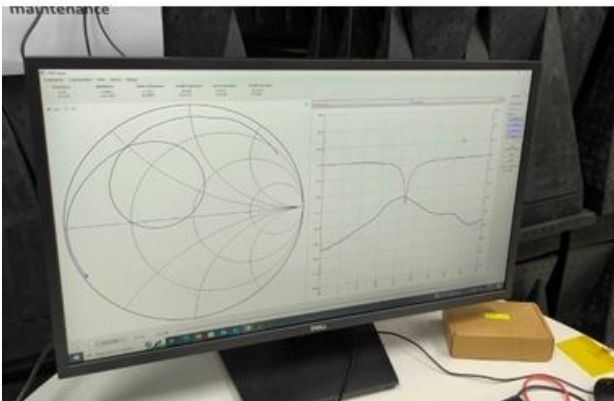
Save the Date

25-26 SEP 09.00 AM - 04.00 PM

Suramate Chalermwisutkul: Panel discussion on IoT Sensor Technology for Development of the Thai Society Advancing Thai Intelligent Sensors: From Research to Market, IMPACT Forum Muang Thong Thani, 10th September, 2024



**Crash Course in IoT Antenna Design using Ansys HFSS, 13th – 14th June, 2024
HFS Lab, Bangkok, Thailand**



Suramate Chalermwisutkul: Panel discussion on IoT Sensor Technology for Development of the Thai Society
Advancing Thai Intelligent Sensors: From Research to Market, Queen Sirikit National Convention Center, 10th September, 2024

- Build strong ecosystems and communities
- Support one another
- Prosper together



HFSLabThailand



High-frequency-systems-laboratory-hfs

High Frequency Systems Laboratory HFS

The Sirindhorn International Thai-German Graduate School of Engineering,
King Mongkut's University of Technology North Bangkok

<https://tggs.kmutnb.ac.th/research-center-labs/high-frequency-systems-laboratory-hfs>
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