Semiconductor and electronics Devices and MEMS Application Technology

Name	KANESHIRO Chinami	E-mail	chinami@okinawa-ct.ac.jp
Status	Professor		
Affiliations	IEEE, MRS, ECS, JSAP, IEICE		

Keywords	Semiconductor Surface and Interfaces, SAW Device, MEMS, Sensing Device
Technical Support Skills	・Device Measurements and Analysis (I-V, C-V, S-Parameters, etc.,) ・Semiconductor Interfaces Analysis ・MEMS: Fabrication technology and Device Analysis

Research Contents — Semiconductor and electronics Devices and MEMS Application Technology

○SAW Devices and Multi-functional Devices

・SAW-Semiconductor Coupled device: To study on fabrication process and characteristics of SAW-semiconductor coupled device. This device will be applied for signal processing devices due to the interaction between SAW and semiconductor Carriers. (Ref. Figure 1)

・SAW Filters and Path-Exchanger: To study on characteristics of SAW filter and Path-exchanger by using periodic structural arrays.

・Photoresponse of pn junction diodes with interlayer of the curcumin pigment.

・Device characteristics of MOSFET with high-k Gate structure. (Ref. Figure 2)

・Sensing system（Non-destructive Testing）: To study on Non-destructive Testing by using PVDF ultrasonic probe. (Ref. Figure 3)

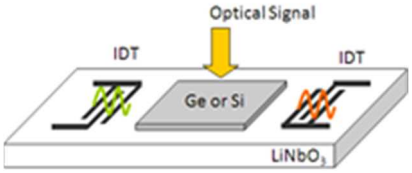


Figure 1 SAW-Semiconductor coupled Device

Figure 2 Various gate structures with high-k material

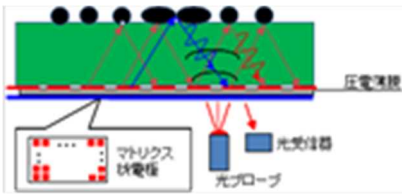


Figure 3 Non-destructive testing/

○Applications by using MEMS technology

・Fabrication of Micro-spring Arrays：To study on fabrication process of micro-spring arrays. This technique is applied for IC testing probe and probes of SPM. (Ref. Figure 4)

・μ-TAS：To study on μ-Total Analysis System , such as micro-pump, micro-reactor, micro-guide, and so on, for chemical reaction system device.

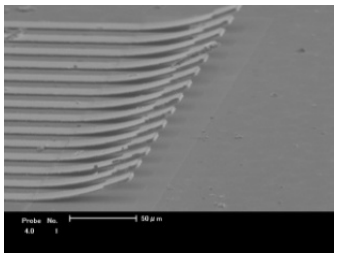


Figure 4 Micro-spring arrays

○Others

・Database: Web application for course evaluation and Class attend.

・Education program and materials for semiconductor device

Available Facilities and Equipment

RF Sputter Vacuum Coater SVC-700 (SANYU Electron)	
Network Analyzer E5061A (Agilent)	
SEM VE-8800 (Keyence)	
Photolithography MA-10 (Mikasa)	
Thermal Oxidation AMF-2P-III (Asahi-rika)	

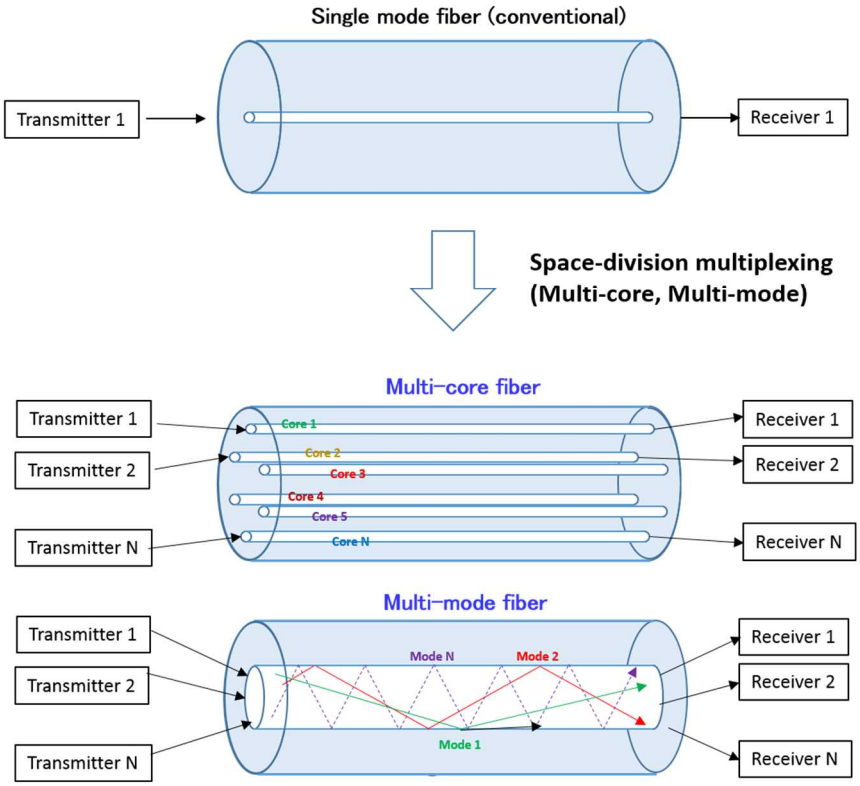
Optical fiber communication : High capacity system and Optical safety

Name	Hidehiko TAKARA	E-mail	h.takara@okinawa-ct.ac.jp
Status	Professor		
Affiliations	IEEE, IEICE, Laser society of Japan		

Keywords	Optical fiber communication, Optical measurement, Optical safety
Technical Support Skills	・Optical fiber characteristics measurement ・Optical transmission characteristics measurement ・Optical safety assessment (based on IEC, JIS standards)

Research Contents

- High capacity optical fiber communication system / subsystem
  (Time-division multiplexing, Wavelength-division multiplexing, Space-division multiplexing,)
- Optical fiber transmission characteristics measurement
- Safety of high power optical fiber communication systems



Fundamental configuration of optical fiber communication system using Space-Division Multiplexing

Available Facilities and Equipment

Information and Communication Systems Engineering,
National Institute of Technology, Okinawa College.

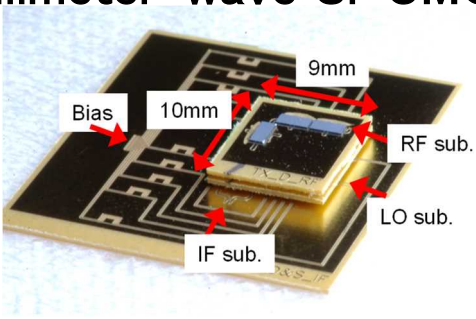
Small RF-IC module using 3D-SiP

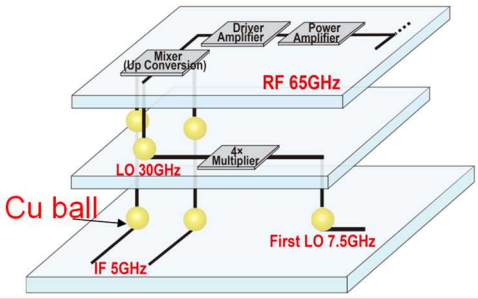
Name	Shoichi TANIFUJI	E-mail	tanifuji@okinawa-ct.ac.jp
Status	Associate Professor, Ph.D. in Engineering		
Affiliations	IEICE, JSAP, JIEP, IEEE		

Keywords	Micro-wave & Millimeter-wave Engineering, RF-IC, 3D-SiP, SBB, Packaging
Technical Support Skills	・3D-SiP Assembly(SBB, Flip-chip) ・Small RF-IC module fabrication

Research Contents

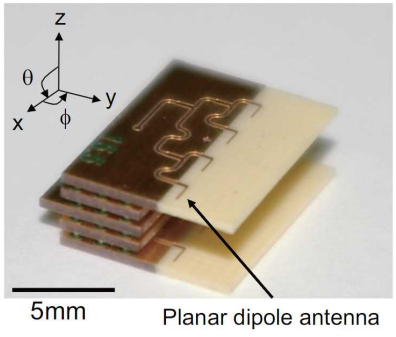
● Millimeter-wave Si-CMOS RF-IC Packaging

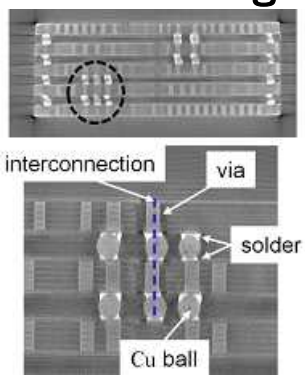




Millimeter-wave RF-IC module fabrication by 3D-SiP using SBB and flip-chip on organic resin substrates stacked with Cu balls.

● Development of Small RF-IC module using 3D-SiP





Fabrication of array antenna module integrated RF-IC and antenna using multi stacked organic substrates by 3D-SiP.

Available Facilities and Equipment

Wire & Ball Bonder(K&S 4522)	
Semi-automatic Flip Chip Bonder(TS-FCB-100)	

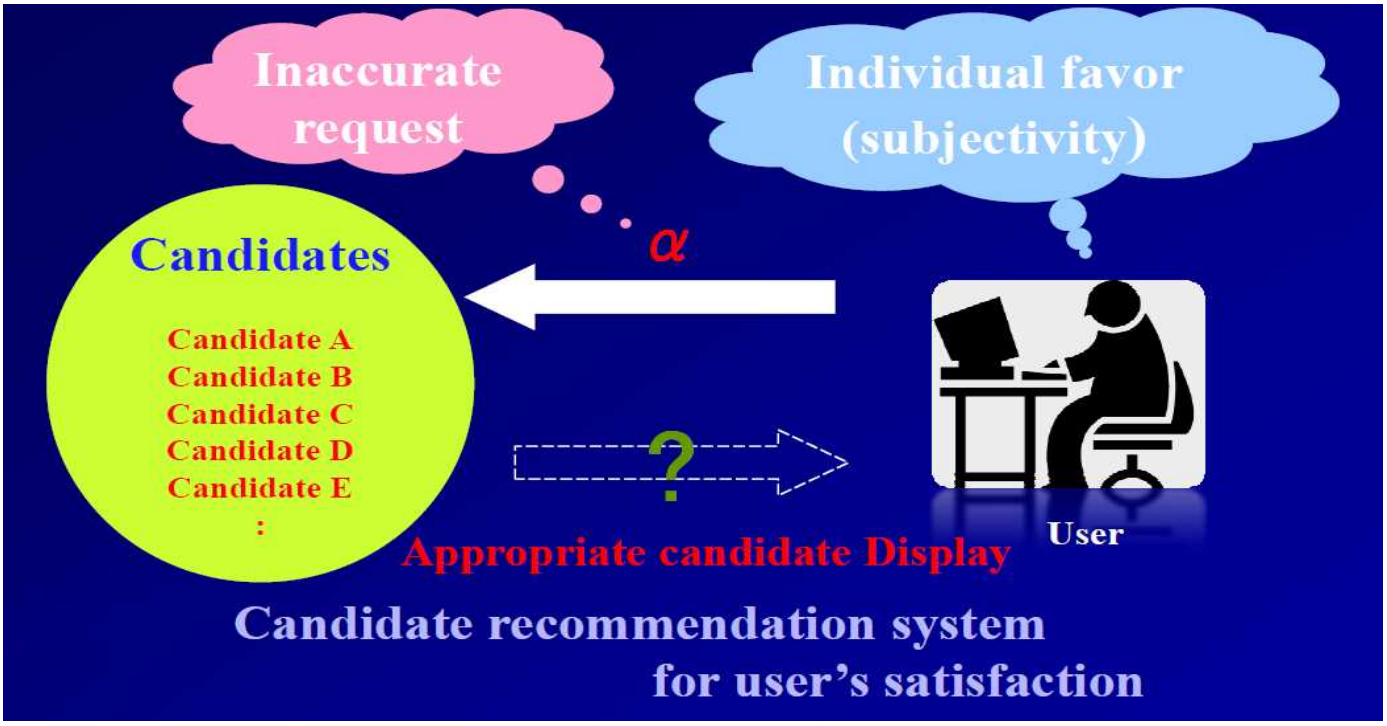
Information and Communication Systems Engineering,
National Institute of Technology, Okinawa College

Decision Making Support System

Name	KINJO Ichiko	E-mail	ichi@okinawa-ct.ac.jp
Status	Professor		
Affiliations	Information Processing Society of Japan		

Keywords	Decision making, Fuzzy analysis, Sightseeing related information processing, OR
Technical Support Skills	・Related technology for decision making ・Data analysis by using fuzzy theory

Research Contents



Available Facilities and Equipment

High-level Design and Verification for Embedded Systems

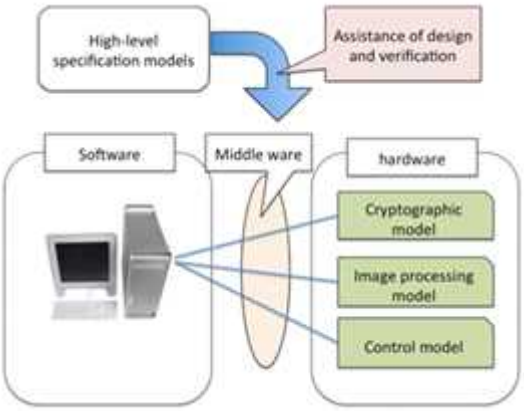
Name	Chikatoshi YAMADA	E-mail	cyamada@okinawa-ct.ac.jp
Status	Associate Professor		
Affiliations	Department of Information and Communication Systems Engineering, National Institute of Technology, Okinawa College		

Keywords	Embedded systems, reconfigurable systems, HPC, model checking
Technical Support Skills	· VHDL/VerilogHDL, Matlab/Simulink, Reconfigurable techniques · FPGA, GPU · Model checking

Research Contents — Development of High-level System Design and Verification

High-level Design and Verification for Embedded Systems

Model checking plays an important role in the design of large scale and complex systems. The technique is applied to software requirement specifications and design specifications, and aims to increase the reliability and productivity. The objective of the work described is to provide a tool chain that supports using SPIN to model check systems specified as Simulink Stateflow models.



Hardware design of algorithms

Bilateral filter can be implemented at a one-chip circuit scale on a Xilinx FPGA.

Parallel processing using GPU

Estimation method of parameters has been proposed as the standard deviation of the prior probability noise distribution. Super Resolution method has been proposed that combines Bilateral Back Projection using Local Variance (BBPLV) and the detection of similar structure and data fusion.

High-level design verification of digital systems using model checking

Tool chains are considered that support using SPIN to model check systems specified as Simulink Stateflow models.

Advantages for previous techniques

Verification shows especially efficient results for structures included behaviors and data using our proposed method.

Expecting application areas

Medical devices, Security devices, Network devices

Available Facilities and Equipment

Logic Analyzer・TLA6202(Tektronix)	FPGA Board・DK-DEV-4SGX230N(Altera)
FPGA Board・ML605(Xilinx)	GPU・GV-TITAN-6GD-B(NVIDIA)
FPGA Board・ML403(Xilinx)	
FPGA NanoBoard 2・NB2(Altium)	
FPGA Board・AES-S6IVK-LX150T-G(Avnet)	

Information and Communication Systems Engineering,
National Institute of Technology, Okinawa College

Development of visual field assessment tool and the simulation software

Name	Kamisato Shihoko	E-mail	kamisato@okinawa-ct.ac.jp
Status	Assistant Professor		
Affiliations	Ipsj, RSJ, Society of Life Support Engineering, Resja		

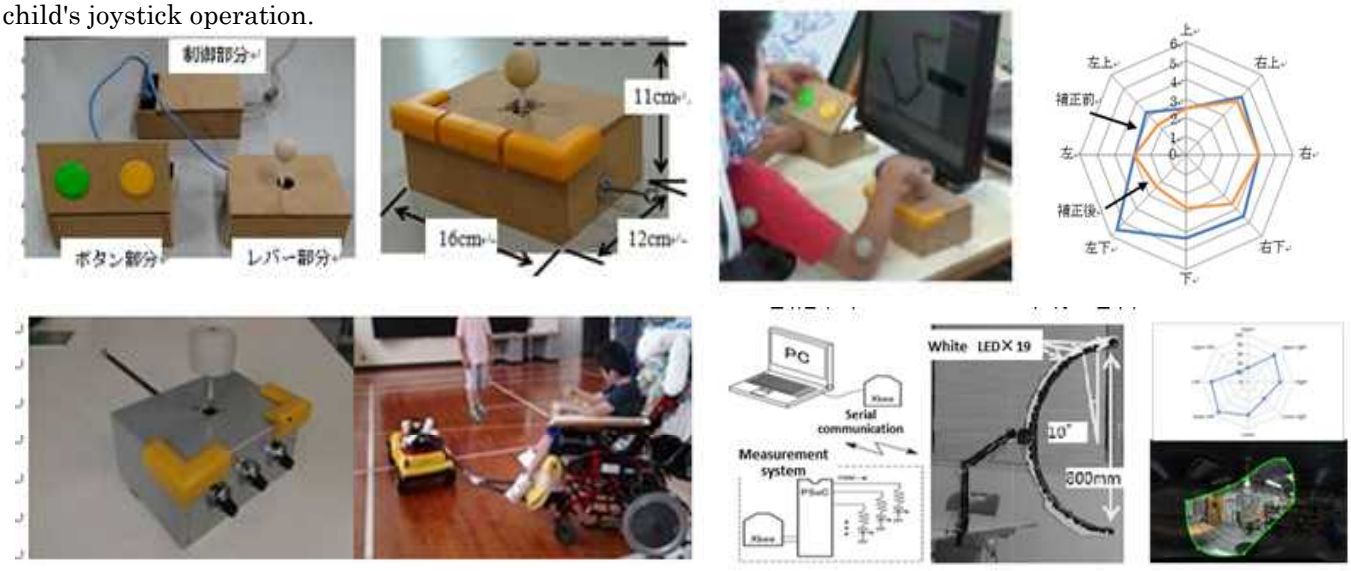
Keywords	Development of Assessment tool, Motion capturing, Quantitative evaluation, Visualization, Development of teaching material
Technical Support Skills	・Motion capturing /Eyes measuring, Brain wave measuring/ Development of teaching material

Research Contents

Development of e-AT（Electronic and Information Technology Based Assistive Technology） tools

・Development of the Joystick-Type Controller for Physically Disabled Child

In the nearby special school, In order to practice the operation of motorized wheelchair, physically disabled child have towed a wheelchair by radio-controlled car. In this study, child operates radio-controlled car by himself and it is aimed to lead to practice the operation of joystick-type controller. Because come out individual differences into joystick operation by individuality of disabilities, physically disabled child is required support and adjustment of the equipment that corresponding to disability. In this paper, we developed the joystick-type controller that can be regulate the reaction angle of the joystick automatically for support to physically disabled child's joystick operation.



Development of electronic and information technology based assistive technology

1. KANSEI data analysis of traditional dancing
2. Measurement and analysis by using motion capturing system
3. Motion simulation and its evaluation

提供可能な設備・機器：

名称・型番（メーカー）	
Measurement system	Brain wave measuring
Motion capture system	
Eye mark	

Information Communication Systems Engineering,
National Institute of Technology, Okinawa College.

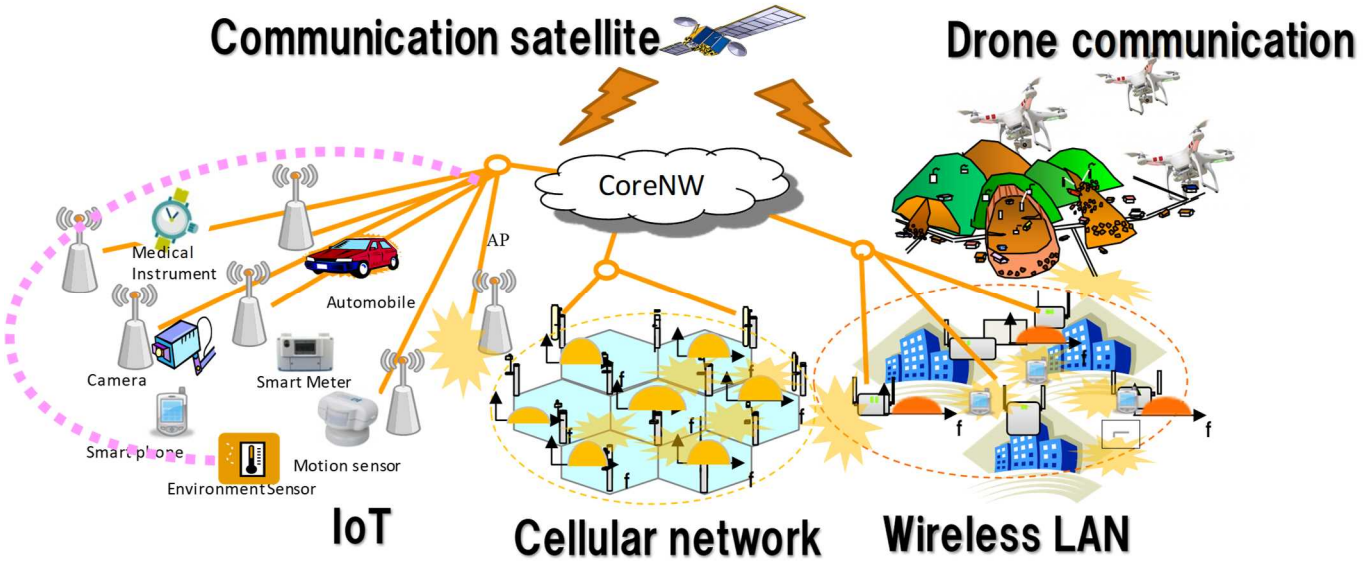
Highly efficient access control for wireless communication systems

Name	Katsuya Nakahira	E-mail	nakahira@okinawa-ct.ac.jp
Status	Associate Professor		
Affiliations	IEICE		

Keywords	Wireless and satellite communication system, Access control scheme
Technical Support Skills	・Total operation, control method and system design of wireless and satellite communication systems ・Radio frequency and transmission power allocation algorithm

Research Contents

1. Studies on access control techniques of total wireless communication systems using satellite, cellular, IoT, WLAN, drone, etc.
2. Studies on radio-wave interference reduction under hetero-genius network environment.
3. Studies on adaptive resource control algorithms corresponding radio-wave and traffic variations.



Available Facilities and Equipment

A study on optical functional system and device

Name	Yohei AIKAWA	E-mail	aikawa.y@okinawa-ct.ac.jp
Status	Assistant Professor		
Affiliations	IEEE IEICE		

Keywords	Optical signal Processing, FEC, Optical comparator, Silicon Photonics
Technical Support Skills	· Silicon photonics design · Non-linear optics, FWM · Convolutional coding and Viterbi decoding

Research Contents — Coding and decoding technologies with optical signal processing

I conduct a study on functional components of optical signal processing to realize more sophisticated optical communication system in the next generation. The research topics in my study are summarized as follows.

- ***Optical Comparison Operation***

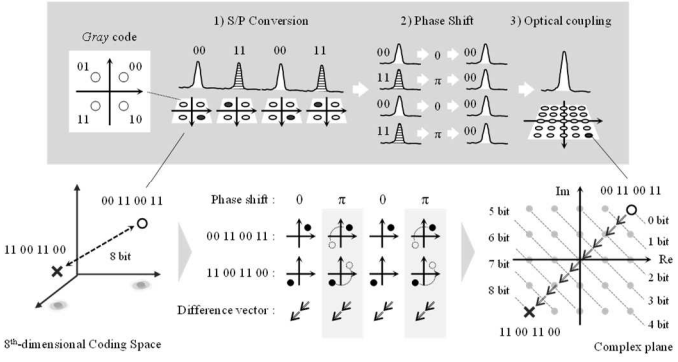
I propose an optical comparison operation, which is a key module of an optical switch or router to replace electrical calculation with optical calculation. I experimentally demonstrated optical comparison operation for 4-bit QPSK-modulated signal, and evaluated their BER performance. The result indicates that the correct comparison operation for QPSK signal can be achieved without electrical processing.

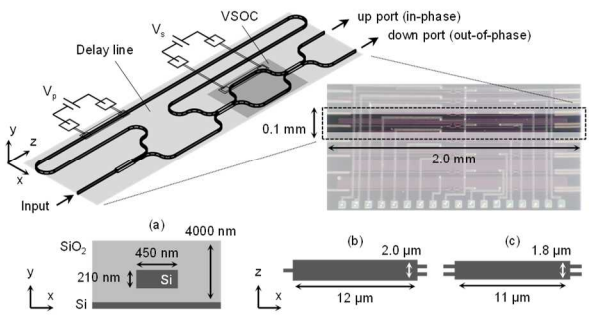
- ***Optical Digital–to–Analog Conversion***

I propose an optical digital-to-analog (DA) conversion to realize an optical switch or router. I experimentally demonstrated optical DA conversion for 2-bit BPSK-modulated signal. The result indicates that the correct operation for BPSK signal can be achieved without electrical processing.

- ***Optical Integration Circuit with Silicon Photonic Technology***

I propose two types of optical integrated circuit by using silicon photonic platform. I designed the circuits; namely, optical FEC coding circuit and optical comparator, respectively. I experimentally evaluated their basic performances.





Available Facilities and Equipment

Development of easy cultivation system using IoT

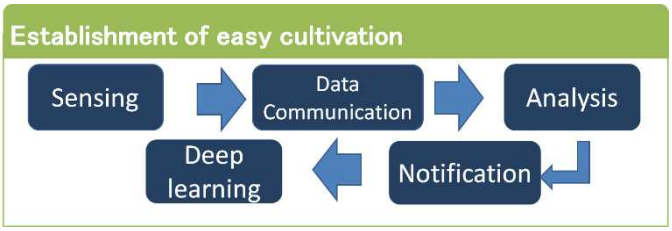
Name	Hiroki KAMEHAMA	E-mail	hkame@okinawa-ct.ac.jp
Status	Research associate		
Affiliations	IEICE, JSAP, IEEE		

Keywords	IoT, Sensing, Data processing, X-ray detector
Technical Support Skills	・Development of IoT Sensing system ・Development of X-ray detector

Research Contents

- **Development of IoT Sensing system**

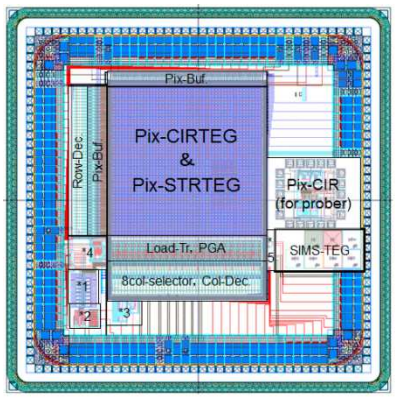
For establishment of easy cultivation, we accumulate plant growing environment and growth condition as data and derive optimal conditions for each plant.



Overview of Hydroponic cultivation

- **Development of X-ray detector (Collaborative research)**

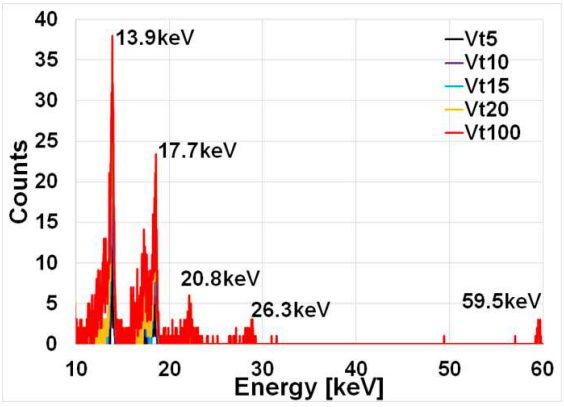
We are working on the development of high sensitivity, low noise and high energy resolution X-ray detector based on SOI technology.



Chip size : 4.5mm × 4.5mm
Thickness : 200μm
Pixel size : 36μm × 36μm
Pixel array : 48 × 48pixel

*1 : S/H, S/H-driver
*2 : OutBuf, OutBuf-Bias
*3 : CSA-Bias, SF-Bias
*4 : Col-Bias, Event-Bias
*5 : PGA-driver

Implemented chip layout



Am-241 spectrum

Available Facilities and Equipment
