

Security IC & AI Solution

2024. 08. 22

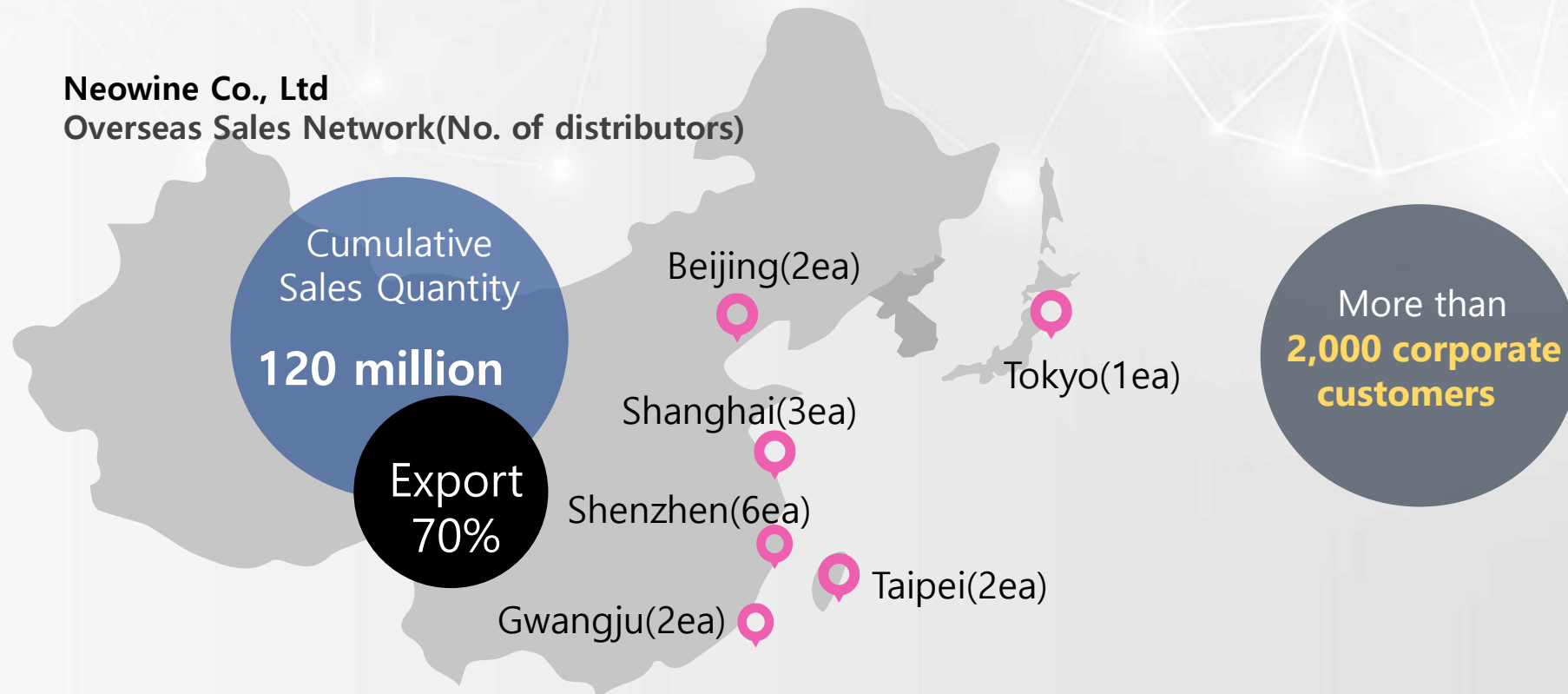
Presenter : Dexter, Managing Director
Email : dexter@neowine.com



- Company Introduction
- Security IC (ALPU Series, DALPU-4)
- AI Business
 - AI semiconductor IPs & ONNX-based SW for IoT edge devices
 - AI- based Counterfeit Product Recognition System
 - AI model for recognizing license plates on parked vehicles
 - AI CCTV Surveillance System
- R & D - MPCs

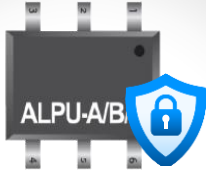
Company Introduction

- **Founded in 2002 & specialized in design and development of security IC (ASIC)**
- **Supplying anti-replication IC, IoT security IC and AI Solutions (AI semiconductor IP & SW, AI Models)**
- **16 distributors in China, Taiwan and Japan, 7 in Korea**
- **Performing R&D tasks such as AI NPU, PIM & Homomorphic Encryption (PQC)**




Company Introduction

Development & Supply of **Anti-replication IC, AI Solutions, and IoT security IC**



ALPU Series
(Anti-replication IC)



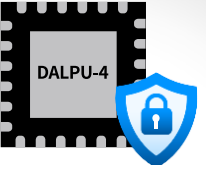
The ALPU Series is represented by a circular icon containing a microchip labeled 'ALPU-AB' with a shield symbol. Below the circle is an illustration of a white car with a red dashed-line field around it, indicating anti-replication technology.




AI Solutions
(IP, Search, educations)



The AI Solutions section features a circular icon with a diamond-shaped microchip labeled 'EONNX'. Below the circle is a collection of icons representing various AI applications, including a laptop, a smartphone, a cloud, a server, and a camera, with the text 'INTERNET OF THINGS' and 'AI' visible.

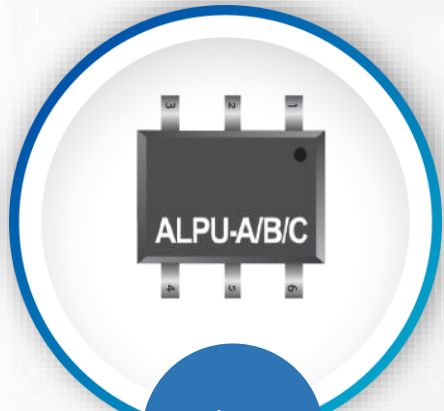


DALPU Series
(IoT Security IC)



The DALPU Series is represented by a circular icon containing a microchip labeled 'DALPU-4' with a shield symbol. Below the circle is an illustration of a white drone with orange accents.

1. ALPU Series – SW Protection



Tiny

Low Power

Low Price

Description

Security IC to prevent illegal copy of system S/W of electronic devices

Products

- **ALPU-A/B/C:** Product certification through certification between **MCU** and **security IC**

High performance illegal copy protection IC
Advanced En/Decryption
Two power mode: Active-mode and Standby-mode
Provide 128bits OTP cells for user serial code
Power select (1.8V/3.3V)

Built-in OSC 16MHz Built-in POR
Standby current 1uA/30uA(1.8V/3.3V)
Active current 300uA
12C interface
Package type SOT23-6L 1.6 x 2.9 X1.1 mm

- **ALPU-CV** **Security IC** for vehicle, **AEC-Q100 Grade 1 (-40 ~ 125°C)**

Firmware copy protection IC
AEC Q100 Certification
Unique group ID
Unique serial No.
Advanced En/Decryption

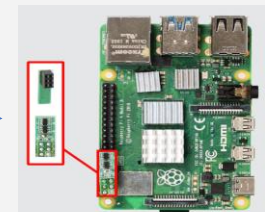
Provide 128 bits OTP cells for user serial code
Power select (1.8v/3.3v)
12C Interface
Package type SOT23-6L 1.6 x 2.9 x1.1 mm

- **Gen-FA: User programmable anti-replication IC**

Firmware copy protection IC, AES-128, SHA-256, I2C, Power 3.3V, **32Kbits EEPROM**

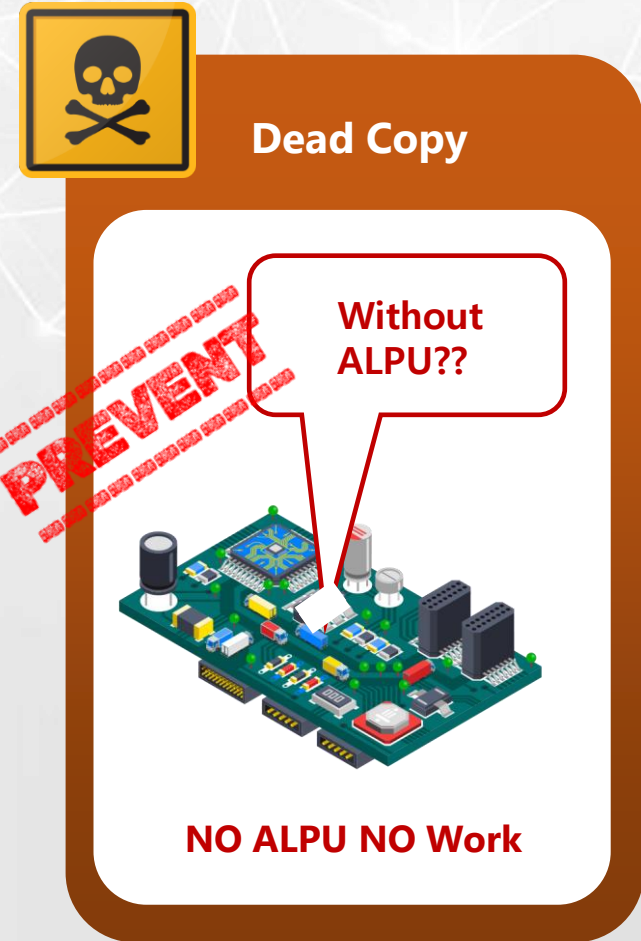
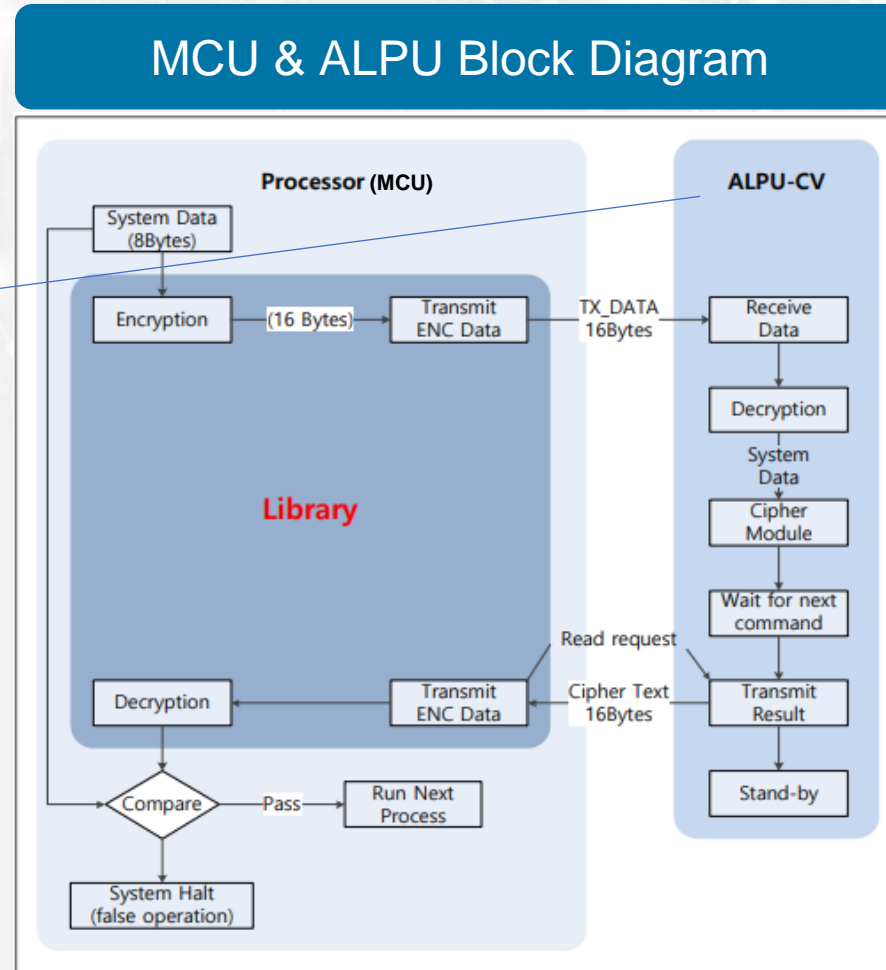
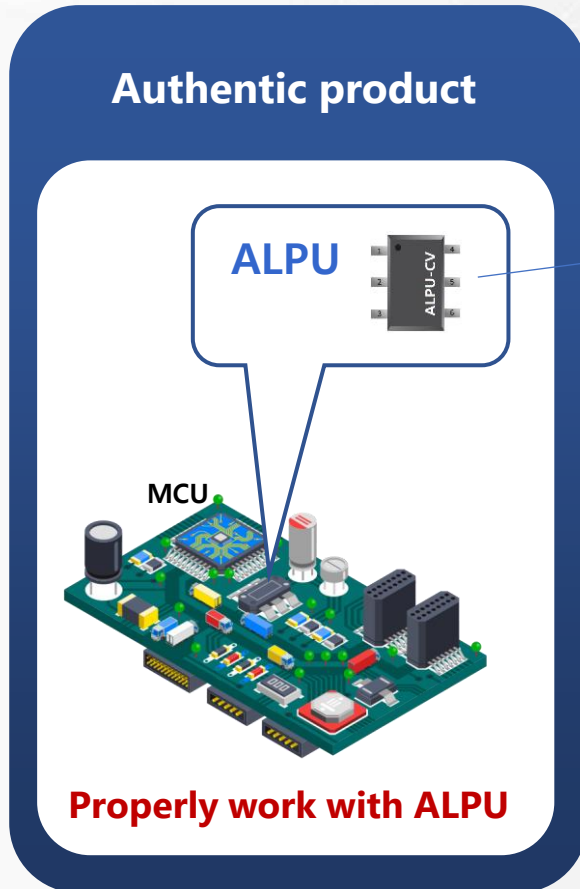
- **ALPU-A1M: Raspberry Pi based Anti-Replication Module** →

Firmware copy protection Module, AES-128/SHA-256, I2C, Power 3.3V, **32Kbits EEPROM**



1. ALPU Series – SW Protection

- Can **prevent dead copy** through authentication between MCU and **ALPU-CV**
- **NO ALPU NO WORK**

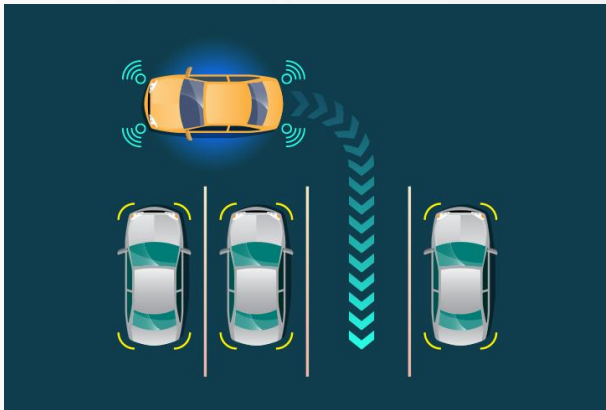


1. ALPU Series – SW Protection

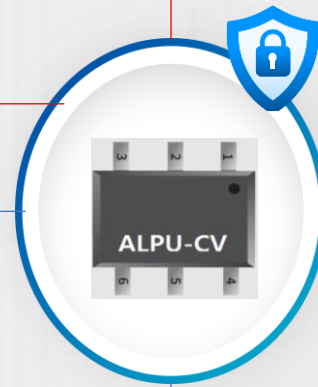
ALPU-CV/C Can be applied to **various kinds of ADAS & AI application**



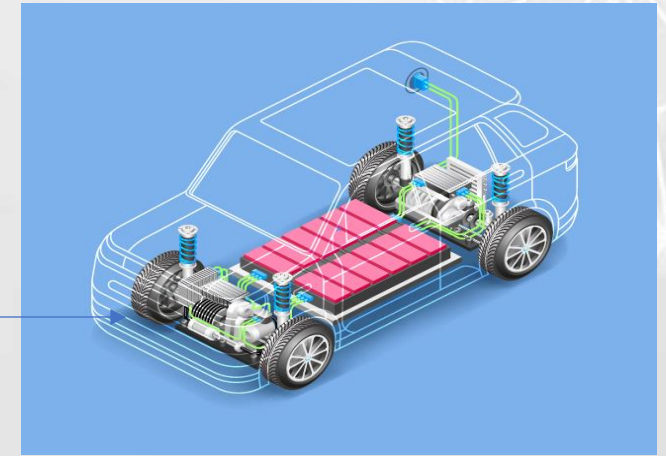
Drowsiness prevention device
[Firmware Protection]



Parking assistant device
[SW Counting for royalty]



Facial recognition & drowsiness prevention device
[Firmware Protection]



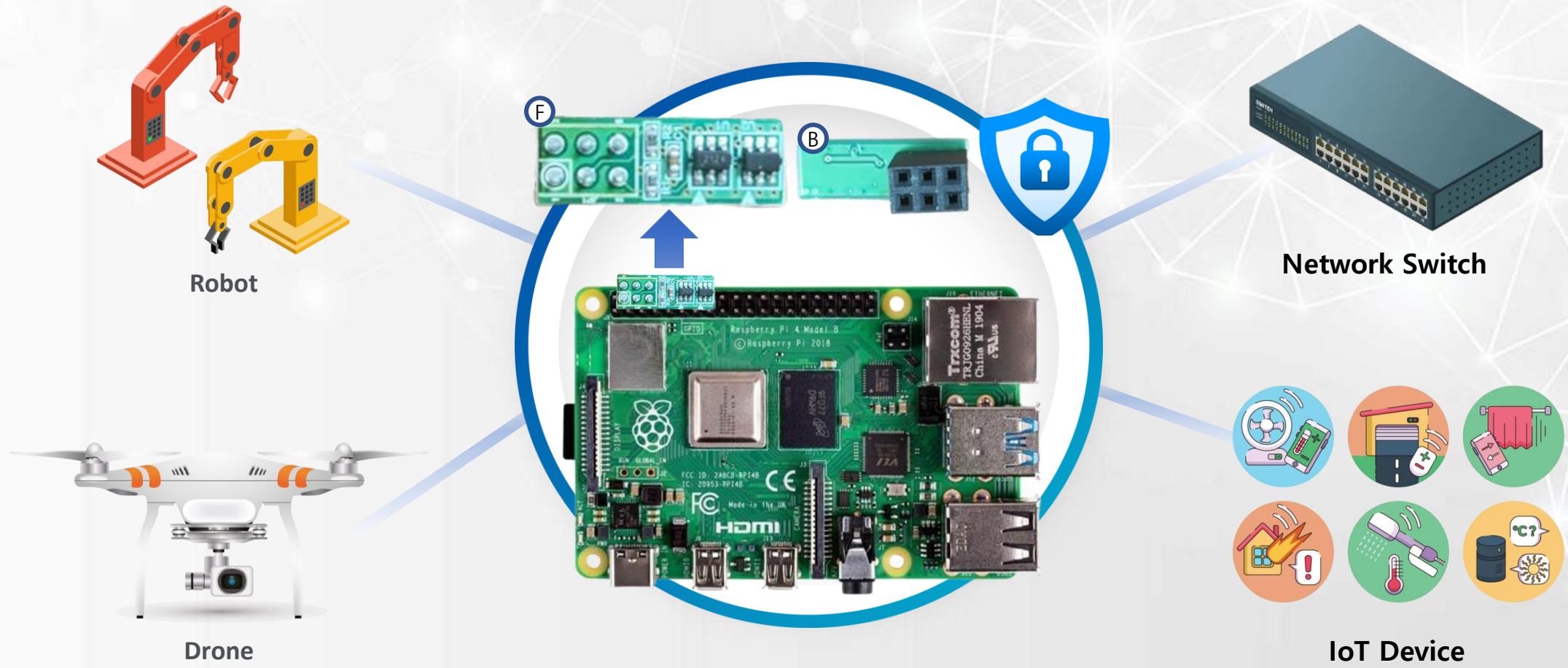
Motor device
[Firmware Protection]



AI IP Camera [Firmware Protection]

1. ALPU Series – SW Protection

ALPU-A1M Raspberry Pi based Anti-Replication Module



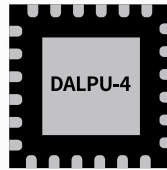
<ALPU-A1M : Anti-Replication Module>

2. DALPU Series - Crypto

PKI-based crypto algorithms for data authentication and crypto processing is implemented
There are IC-typed **DALPU4**, USB-shaped **DALPU-USB**, and modular-typed **DALPU-D4M**.

DALPU4

KCMVP



IC-type, applicable for **data crypto and certification**

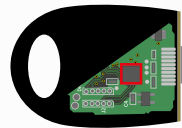
ECC, RSA, AES, SHA, TRNG, EEPROM, PUF, SPI 2Ch
Active 10mA, Sleep 50uA
Package type TQFN 4 x 4 mm 24L

Tiny

Low
Power

Low
Price

DALPU-USB



USB interface support, applicable for data crypto and certification

DALPU-D4M

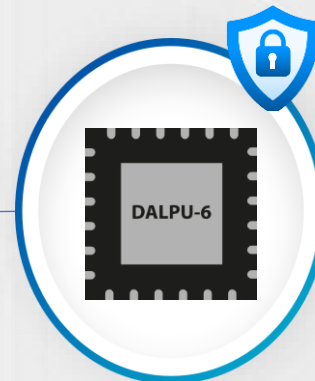
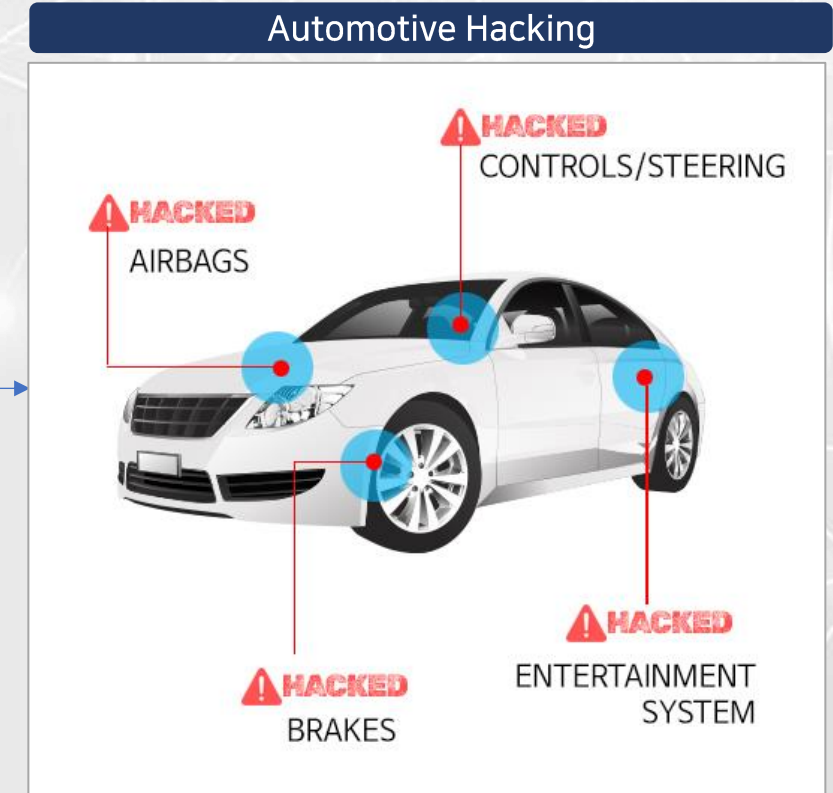


When developing Raspberry Pi-based products

Applicable for data crypto and certification

2. DALPU Series - Crypto

- Brakes, steering, airbag and entertainment systems of connected cars are at **risk of being hacked**
- **Keep your valuable life with DALPU**



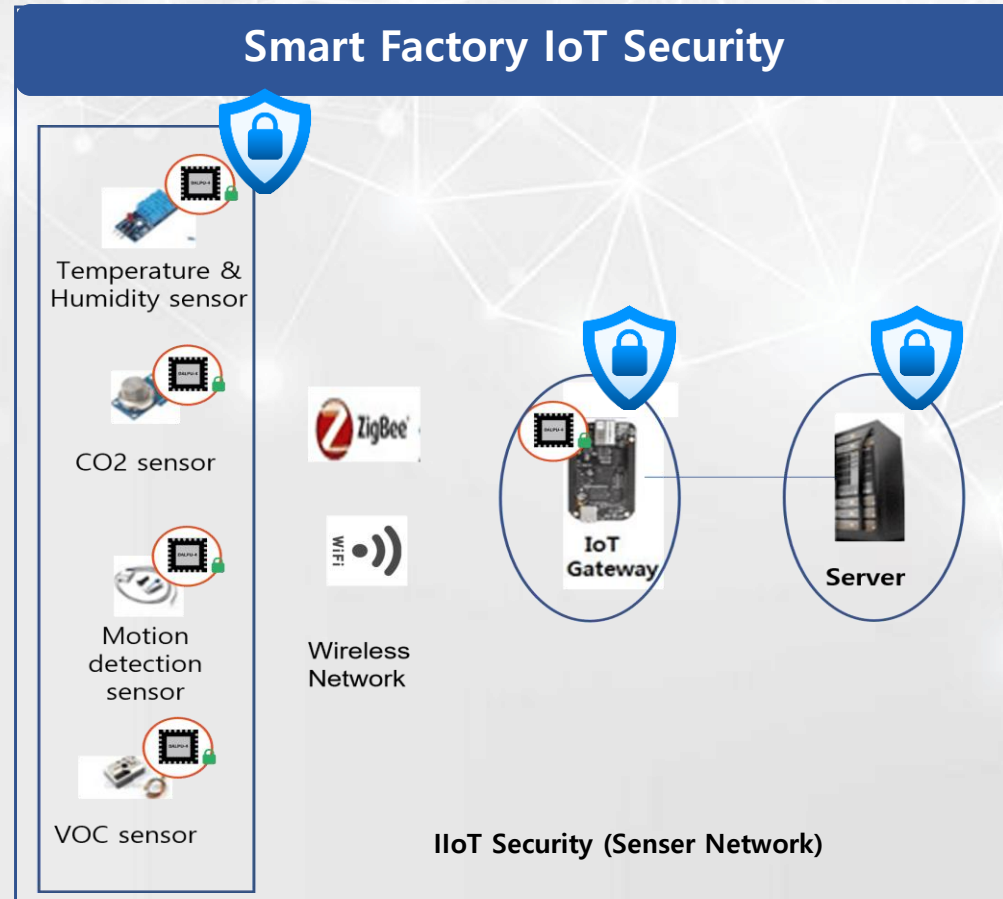
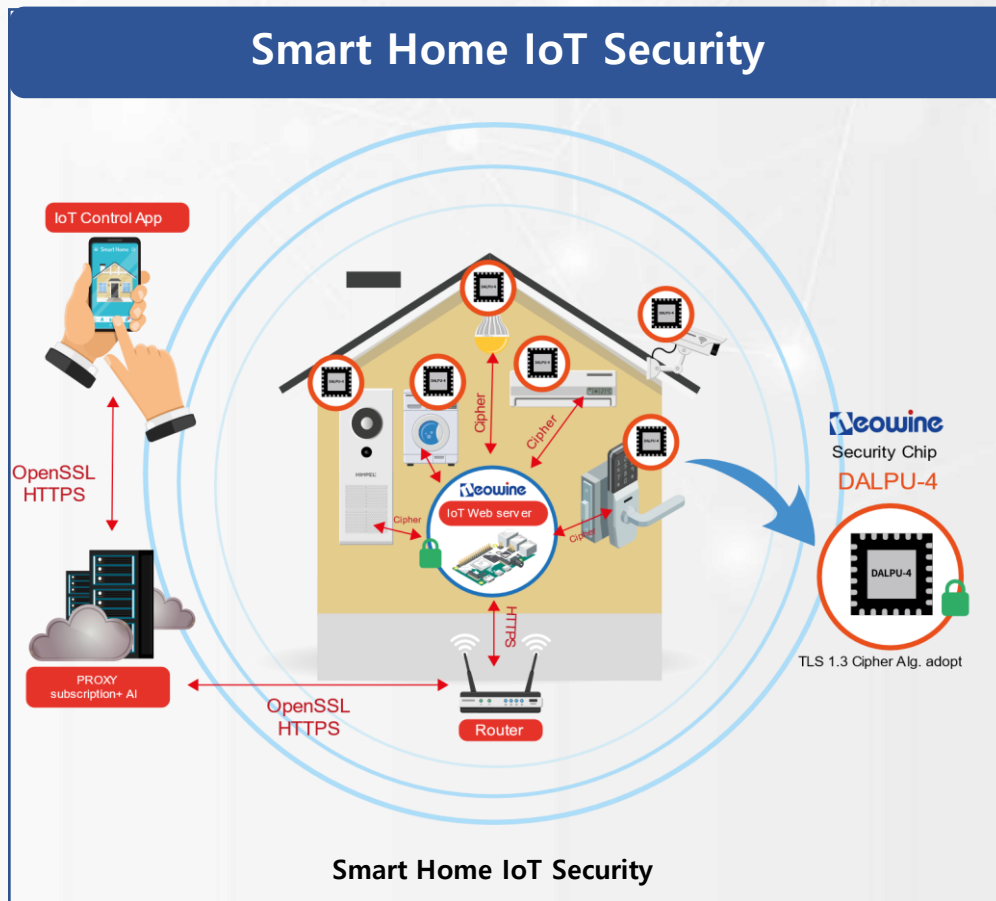
- Secure Boot
- Secure Firmware Update
- OTA Secure Firmware Update
- Secure Communication

Various communications and software systems leaves automobiles vulnerable to attack

2. DALPU Series - Crypto

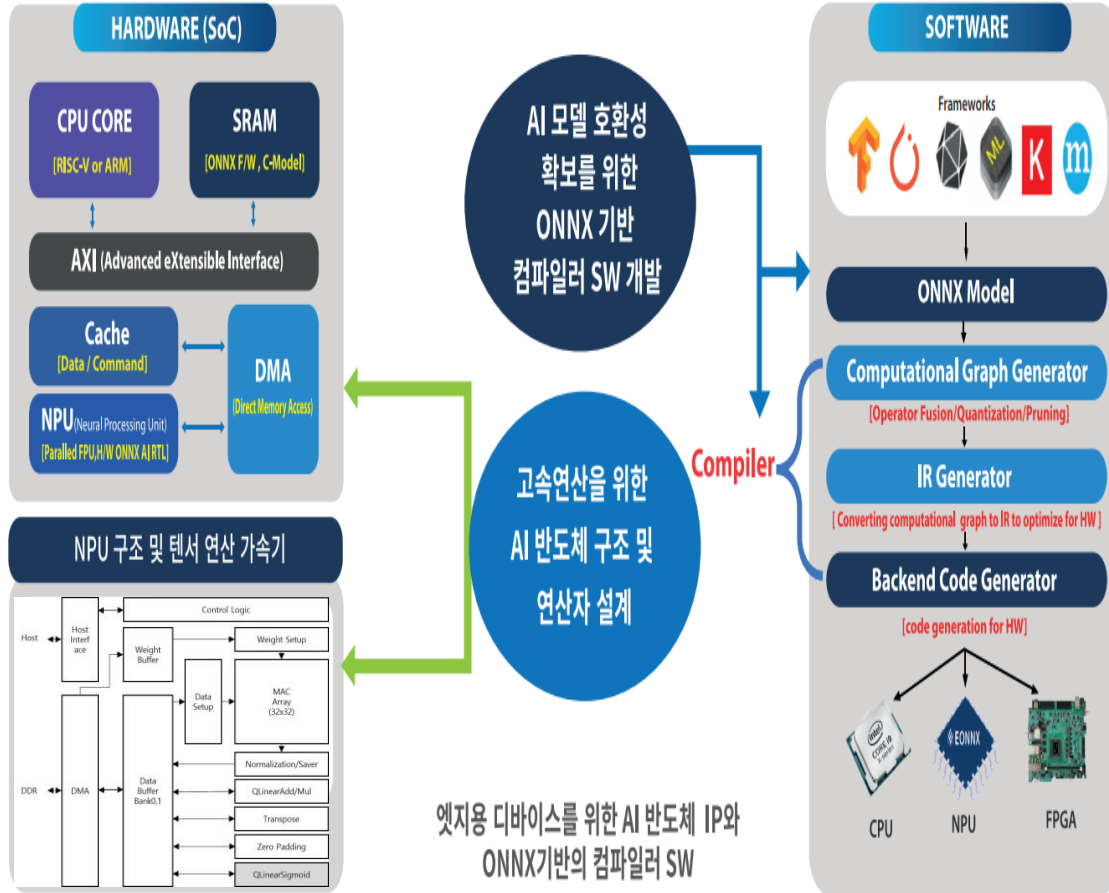
DALPU can be applied **to smart home & factory devices to protect data and prevent hacking**

Asymmetric Encryption (ECDH & ECDSA)



1. AI semiconductor IPs & ONNX-based SW for IoT edge devices

AI semiconductor IP & Compiler



Key Features

Product Usage

AI semiconductor design IP for real-time high-speed operation of edge AI models, and compiler software for optimal execution of AI models

Product Features

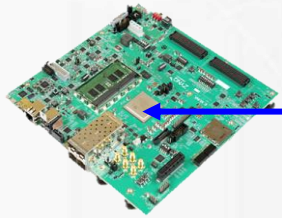
- NPU IP
 - 4 TOPS
 - 1,024 MAC Array Processor
 - Support for 14 operators including convolution
- SW (Compiler)
 - ONNX structure
 - Support for AI models based on TensorFlow and PyTorch
 - Optimization through quantization and operator fusion
- AI SoC is under development through R&D

Usages Areas

- Fabless company
- FPGA-based AI Service development company
- Edge AI semiconductor development and research institution (such as schools, R&D institutions)
- AI module development company (such as AI CCTV, AI robot)

1. AI semiconductor IPs & ONNX-based SW for IoT edge devices

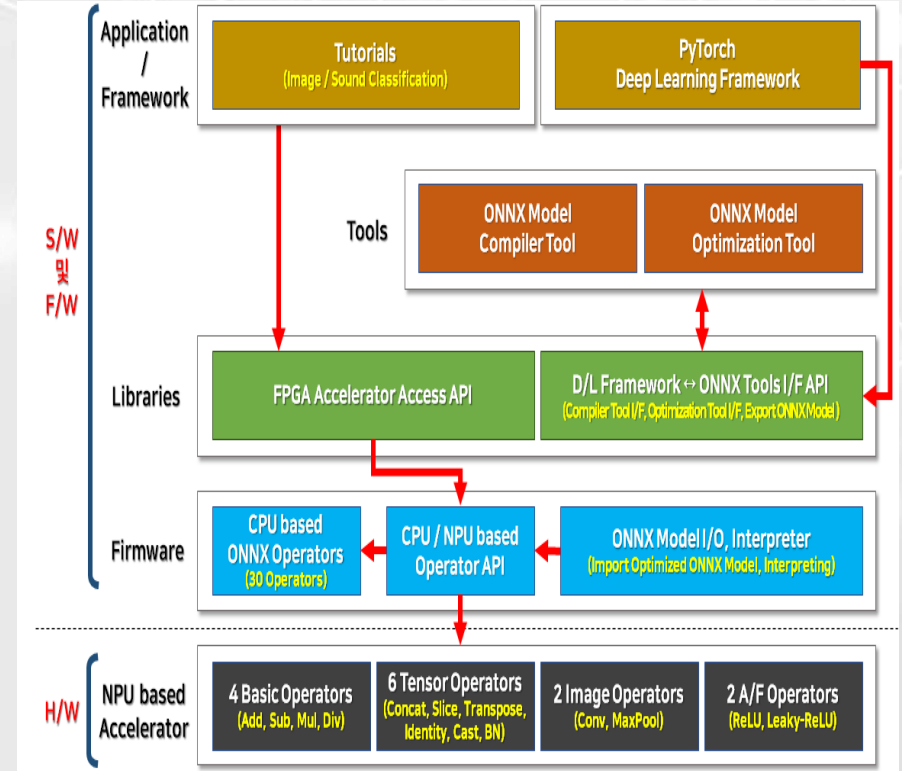
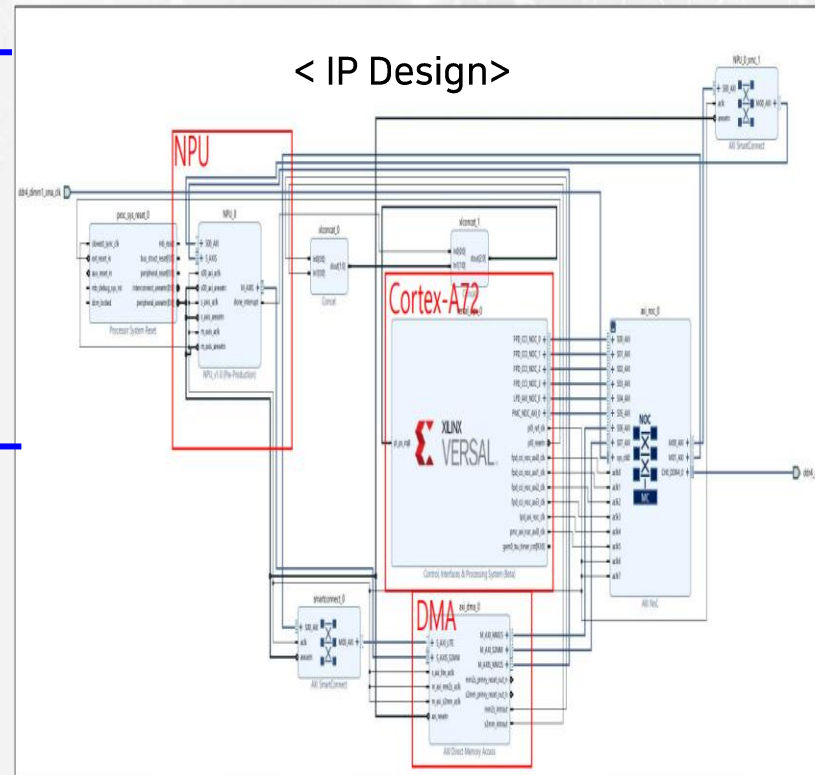
- (NIPA) Development of AI Semiconductor IP
 - Setting up the H/W Development Environment/
 - Zynq Ultrascale+ 및 Xilinx FPGA VMK-180



< Xilinx Zynq Ultrascale+ >



< Xilinx VMK-180 >



1. AI semiconductor IPs & ONNX-based SW for IoT edge devices

- (NIPA) Development of AI Semiconductor IP
 - NPU Supported Models
 - Object Detection Model : Q-MobileNetV2+SSD, Q-YOLO

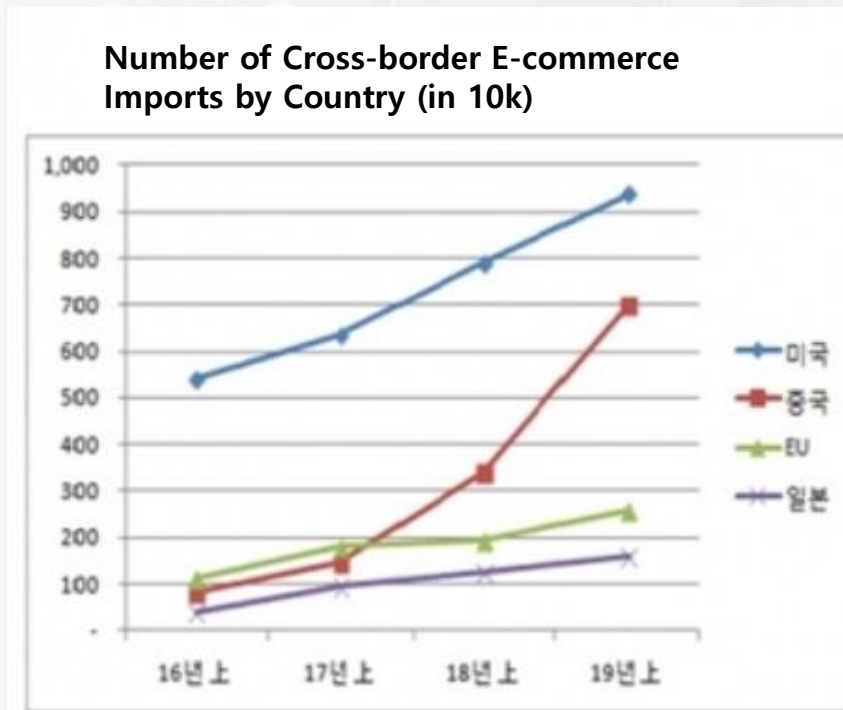
NPU inference Demo Video

2. AI-based Counterfeit Product Recognition System

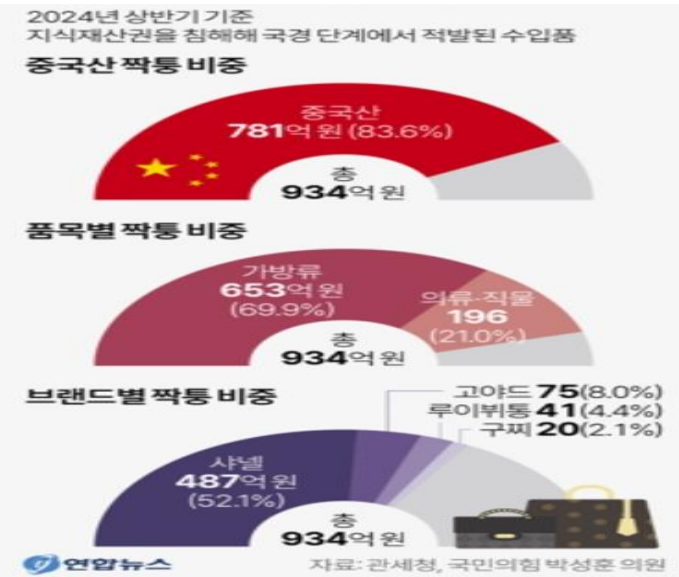
■ (NIPA) Establishment of AI-based Counterfeit Product Recognition System

● AI-based Counterfeit Product Recognition System

- With the increase in imports and overseas direct purchases, the number of detected cases of counterfeit products has risen [The number of cases increased from 34,624 in `21 to 62,326 in `22]



Status of Counterfeit Imports Detection

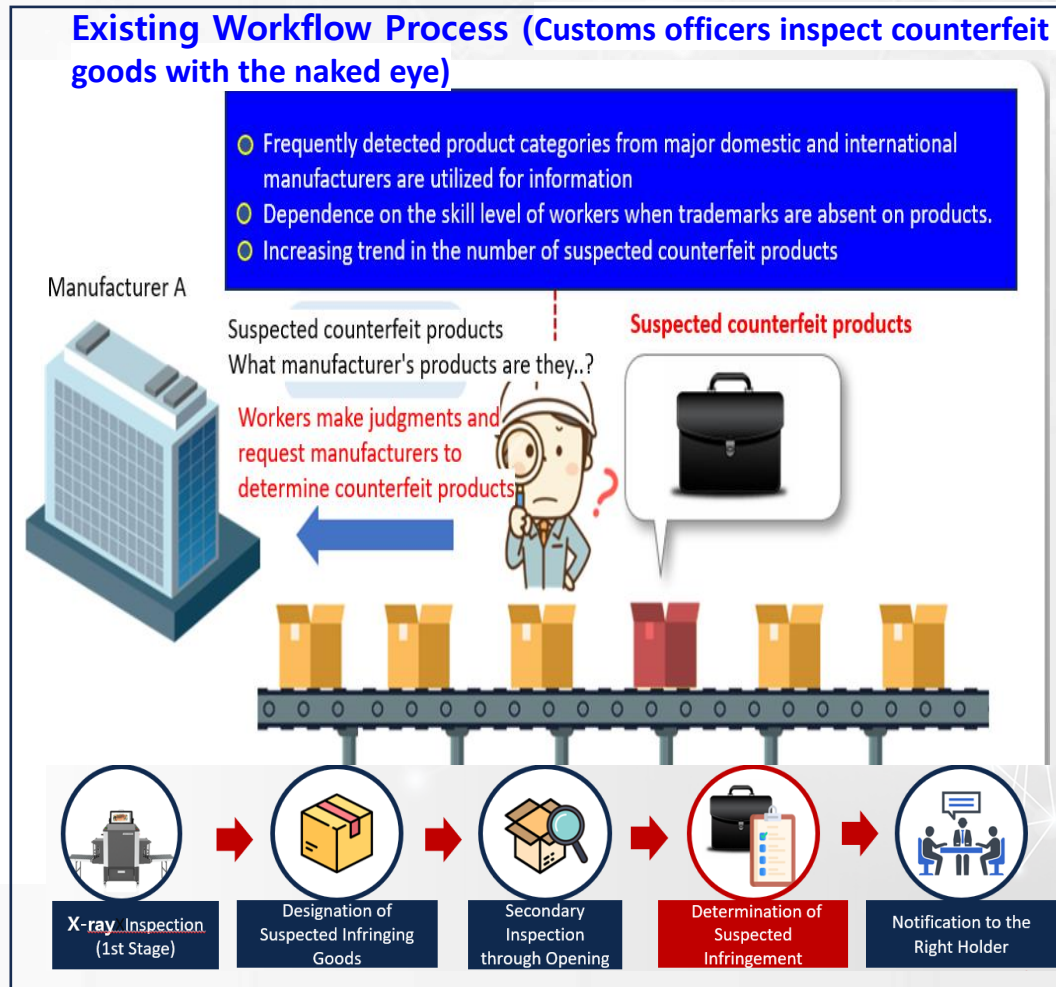


- Every year, over 50,000 new registrations of intellectual property rights (design rights) are made
- The limited manpower poses challenges in carrying out the task of detecting counterfeit products

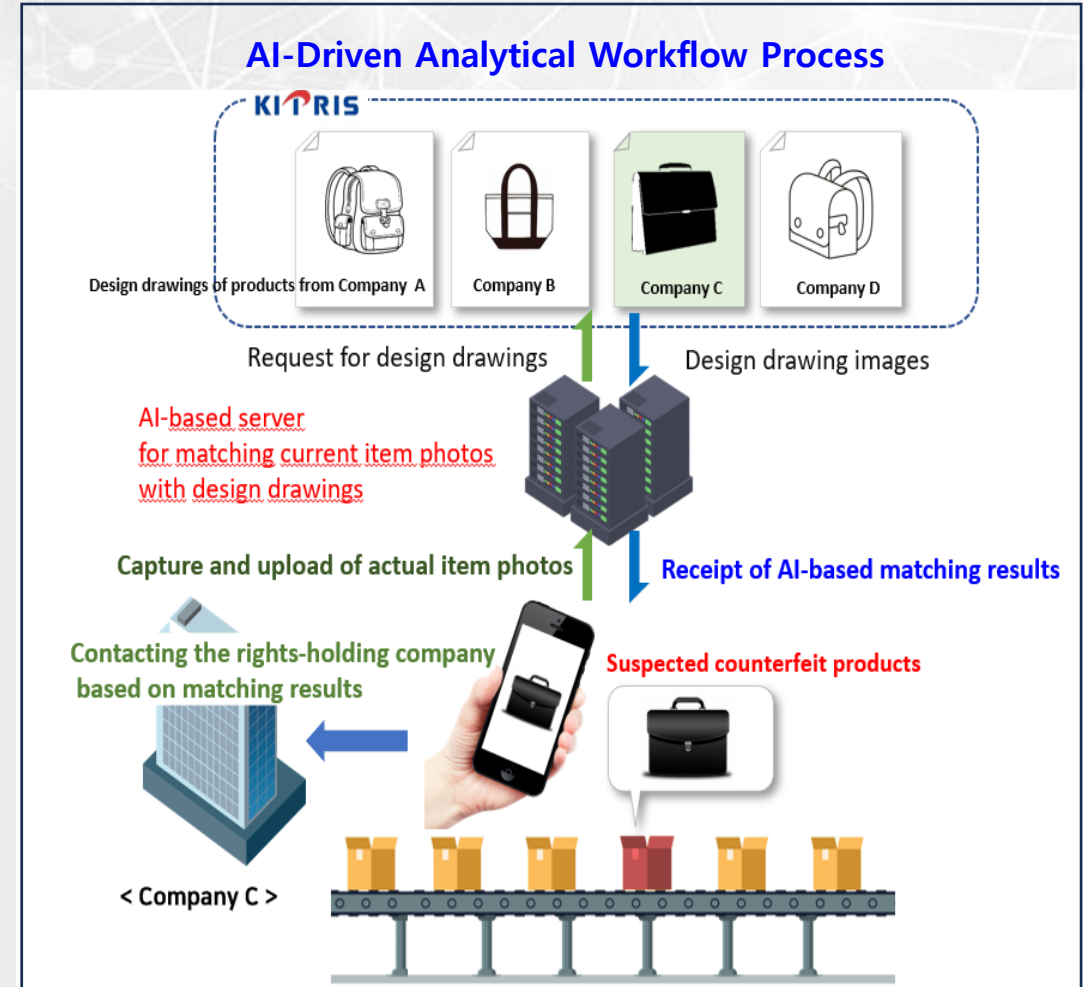
2. AI-based Counterfeit Product Recognition System

■ (NIPA) Establishment of AI-based Counterfeit Product Recognition System

As-Is



To-Be

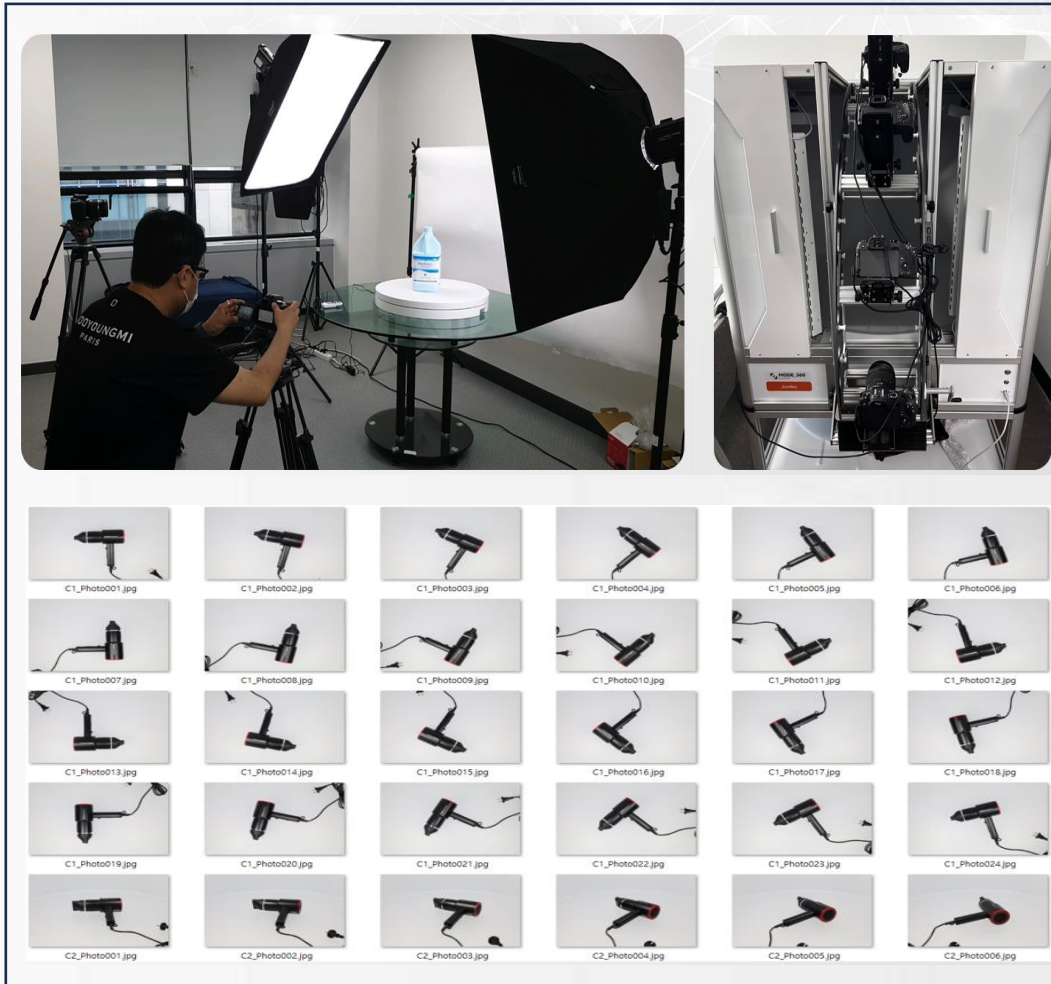


2. AI-based Counterfeit Product Recognition System

■ (NIPA) Establishment of AI-based Counterfeit Product Recognition System

- Data Collection

AI Model Training and Testing



Training Pipeline

```

            graph LR
            A[Drawing <-> Real] --> B[Train]
            A --> C[Train]
            B --> D[SimCLR]
            C --> E[SimCLR]
            D --> F[Drawing Feature]
            E --> G[Drawing Feature]
            F --> H[Category 1]
            G --> I[Category 2]
            H --> J[Annov 1]
            I --> K[Annov 2]
            J --> L[Annov 3]
            K --> L
            
```

Inference Pipeline

```

            graph LR
            M[TokenCut] --> N[Crop]
            N --> O[CLIP]
            O --> P[category]
            O --> Q[category]
            O --> R[category]
            P --> S[SimCLR]
            Q --> T[SimCLR]
            R --> U[SimCLR]
            S --> V[Feature]
            T --> W[Feature]
            U --> X[Feature]
            V --> Y[Annov 1]
            W --> Z[Annov 2]
            X --> AA[Annov 3]
            Y --> AB[numbers]
            Z --> AC[numbers]
            AA --> AD[numbers]
            AB --> AE[Result *3]
            AC --> AE
            AD --> AE
            
```


2. AI-based Counterfeit Product Recognition System

■ (NIPA) Establishment of AI-based Counterfeit Product Recognition System

● AI Model Training and Testing

■ 1:1 Verification : **99.9%** (AUROC Score)

■ Top-1 Accuracy : **97.4%**

Conditions / Major Categories		Unit (%)					
		Home Appliances	Beauty Products	Automotive Parts	IT Products	Toys & Stationery	Fashion Accessories
Lighting	Normal	100.00	96.00	100.00	96.67	91.30	96.00
	Dim	100.00	94.67	95.24	93.33	82.61	90.67
	Very Dim	100.00	94.00	97.62	92.50	86.96	92.00
Obscured	Yes	100.00	96.00	97.62	95.00	86.96	94.00
	No	100.00	96.00	97.62	97.50	86.96	94.00
Overall		100.00	95.33	97.62	95.00	86.96	93.33

■ Top-3 Accuracy : **99.4%**

Conditions / Major Categories		Unit (%)					
		Home Appliances	Beauty Products	Automotive Parts	IT Products	Toys & Stationery	Fashion Accessories
Lighting	Normal	100.00	100.00	100.00	96.67	100.00	100.00
	Dim	100.00	100.00	100.00	95.00	100.00	100.00
	Very Dim	100.00	100.00	100.00	95.00	100.00	100.00
Obscured	Yes	100.00	100.00	100.00	95.00	100.00	100.00
	No	100.00	100.00	100.00	97.50	100.00	100.00
Overall		100.00	100.00	100.00	95.83	100.00	100.00

Evaluation of Satisfaction at Pyeongtaek Customs

○ Individual survey scores

Item	Company name	Convenience	Response speed	Stability	Accuracy	Reliability	Satisfaction	Average	Rank
D	NEOWINE	4.08	4.08	4.29	4.42	4.21	4.04	4.19	1

○ Scores by morning/afternoon participants

Participants	Company name	Convenience	Response speed	Stability	Accuracy	Reliability	Satisfaction	Average
Morning	NEOWINE	4.17	3.67	3.83	4.33	4.17	4.33	4.08
Afternoon.	NEOWINE	4.00	4.50	4.75	4.50	4.25	3.75	4.29
Average		4.08	4.08	4.29	4.42	4.21	4.04	4.19

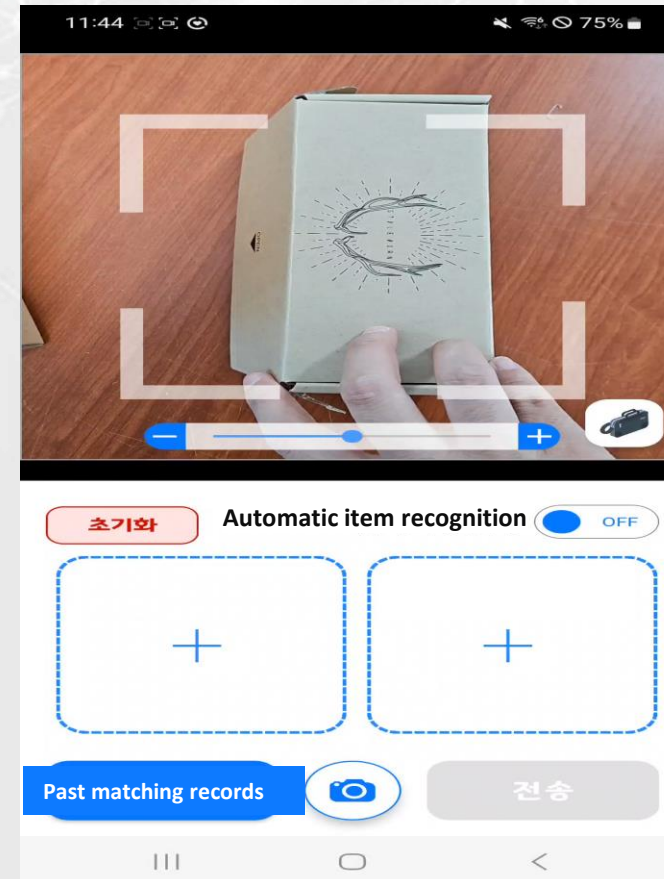
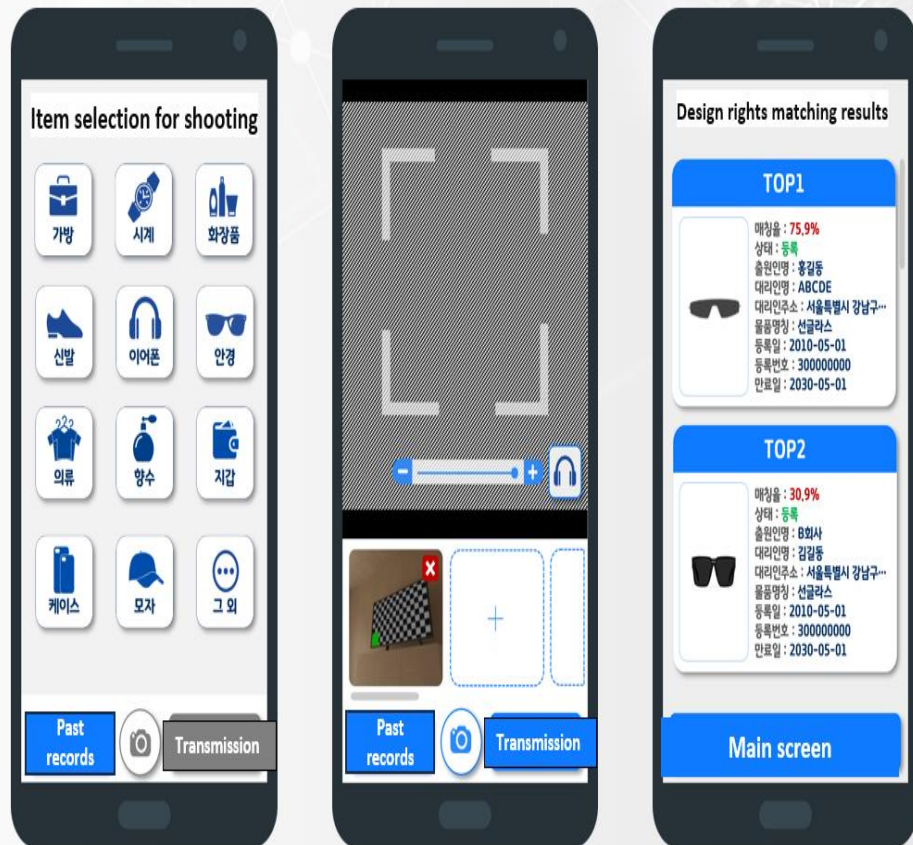
The on-site evaluation resulted in our consortium being ranked number one with a score of 4.19 out of 5.

2. AI-based Counterfeit Product Recognition System

■ (NIPA) Establishment of AI-based Counterfeit Product Recognition System

● Mobile App Development

Demo Video of Item Recognition and Inference



3. AI model for recognizing license plates on parked vehicles

■ Implementation of License Plate Recognition AI Algorithm

● Image Collection and Implementation of AI Algorithm

- Detector Model : Yolo
- OCR Algorithms : LPRNet
- Quantization, Image Processing

■ Accuracy : 99.7%



Conditions	Unit (%)
Old license plate (1996~2006)	97.17%
New license plate (2006~2019)	99.99%
Reflective film type plate(2019~)	97.17%
Eco-friendly car- specific license plate (2017 ~)	100.00%
Corporate vehicle- specific license plate(2023~)	100.00%
Integration	99.77%

- Implementation of License Plate Recognition AI Algorithm
 - Demo Video of AI License Plate Recognition



4. AI CCTV Surveillance System

- AI analyzes fires from CCTV (IP) video signals and provides real-time notifications to users
 - AI model based on YOLO
 - Securing fire-related datasets and training AI model
 - Performance : 97%(HD), 98.7%(FHD)/ Recognition Speed : Under 50ms

AI CCTV Surveillance System



Key Features

Product Usage

AI CCTV video security system that uses artificial intelligence to analyze fire and provide real-time alerts to users

Product Features

- AI models based on YOLO are applied
 - AI flame detection model
 - AI smoke detection model
 - AI vehicle number recognition model
- Product
 - IPC, AI inference server, VMS server, and monitor

Usages Areas

- Supply of CCTV-based video security systems
 - Fire (smoke/flame), vehicle, and access management
- Supply of AI models
 - Flame, smoke, and vehicle license plate recognition AI models

■ Fire & Smoke Detection DEMO



5. MPCs (Solution for reducing semiconductor development costs and development time)

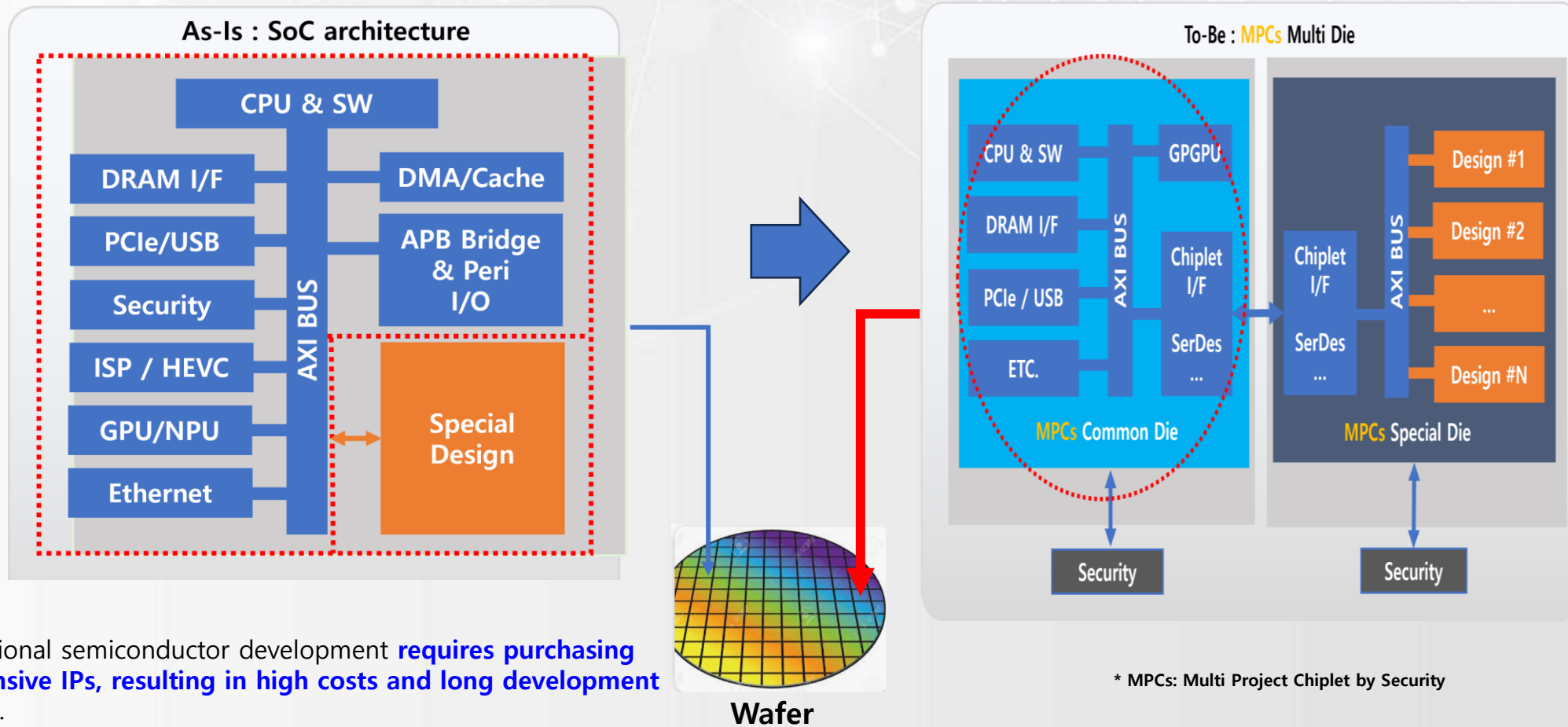
- In semiconductor development, more advanced fabrication processes lead to skyrocketing costs and longer timelines, requiring a solution to this challenge

In a 3-nanometer process, the development cost is approximately 860 million dollars.

T	TSMC	Intel	S	Intel	S						TSMC	
Process	Tr Count			Process Adjust		Density	RnD USD	Wafer	Wafer USD	Wafer	Unit Price	RnD/Die Parity
Factor	sq mm	sq mm	sq mm	Transister		5x5	million	8/12	TSMC	sq cm	Die Cost	EA
nm	Million	Million	Million	P*(T/S)^0.5		Mega	Cost A	inch	Price B	Area C	B/C=D	A/D=E
130						1	2.0	8	1,200	324	3.7	540,000
65						4	28.5	12	3,000	729	4.1	6,925,500
28						22	51.3	12	3,000	729	4.1	12,465,900
16	28.9	44.7	33.3	12.9	14.9	66	106.3	12	5,000	729	6.9	15,498,540
10	53.0	106.0	52.0	7.1	10.1	169	174.4	12	8,000	729	11.0	15,892,200
7	97.0	180.0	95.0	5.1	7.1	345	297.8	12	10,000	729	13.7	21,709,620
5	173.0	300.0	127.0	3.8	5.8	676	542.2	12	16,000	729	21.9	24,703,988
3	290.0	520.0	170.0	2.2	3.9	1,878	860.0	12	20,000	729	27.4	31,347,000
2	490.0					4,225	1,200.0	12	25,000	729	34.3	34,992,000
1.4						8,622	2,000.0	12	30,000	729	41.2	48,600,000

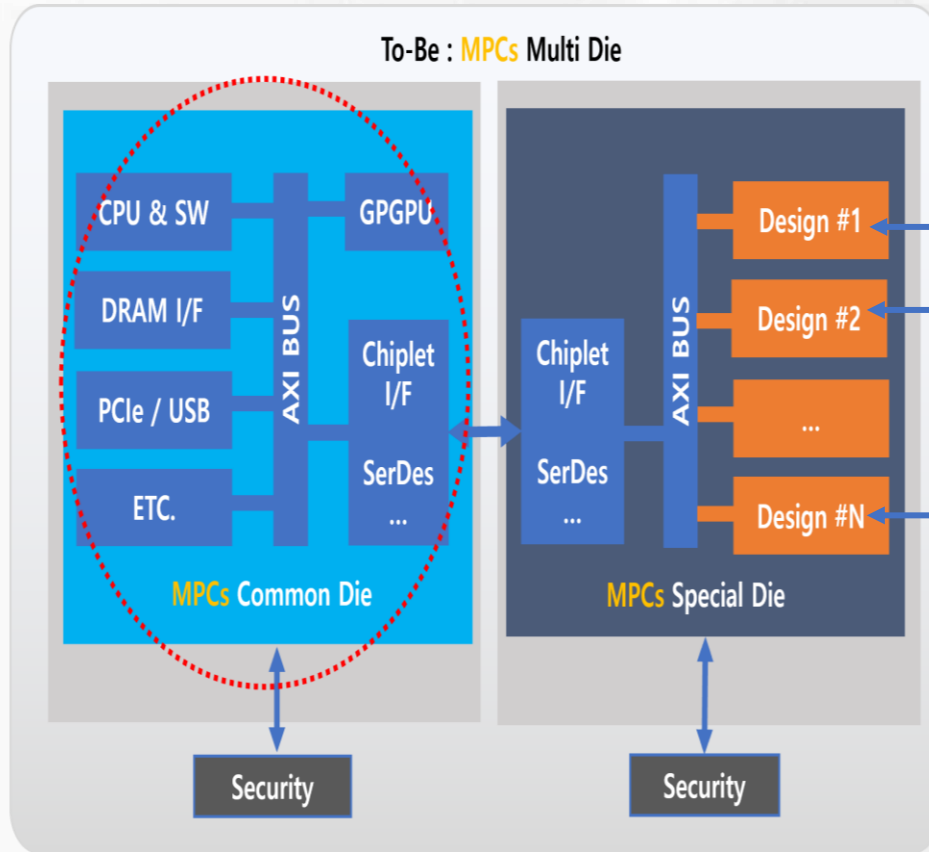
5. MPCs (Solution for reducing semiconductor development costs and development time)

- The proposed MPCs approach uses **common dies** for high-cost IPs and **special dies** for custom development
- This setup allows companies to **purchase the common die without additional development, package it with the special die, and thereby reduce both development costs and time.**



5. MPCs (Solution for reducing semiconductor development costs and development time)

- Expected to be applied in high-performance security semiconductors, AIoT sensor products, AI-based drones, AI-robots, and AI-camera development



High Performance Security

- Post Quantum Cryptography; PQC
- KCMVP Certified Chip
- Homomorphic Encryption
- 1G ~ 10Gbps SSL



AIoT

- Various sensor inputs
- Various control outputs



etc.

- Drone, Robot etc.



* MPCs: Multi Project Chiplet by Security

Thank You !

www.neowine.com



For the Secure world