Go Beyond

The ERA of Blockchain Network and Metaverse

NS LAB
NETWORKED SYSTEMS LABORATORY

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About NSLab

Vision and Goals

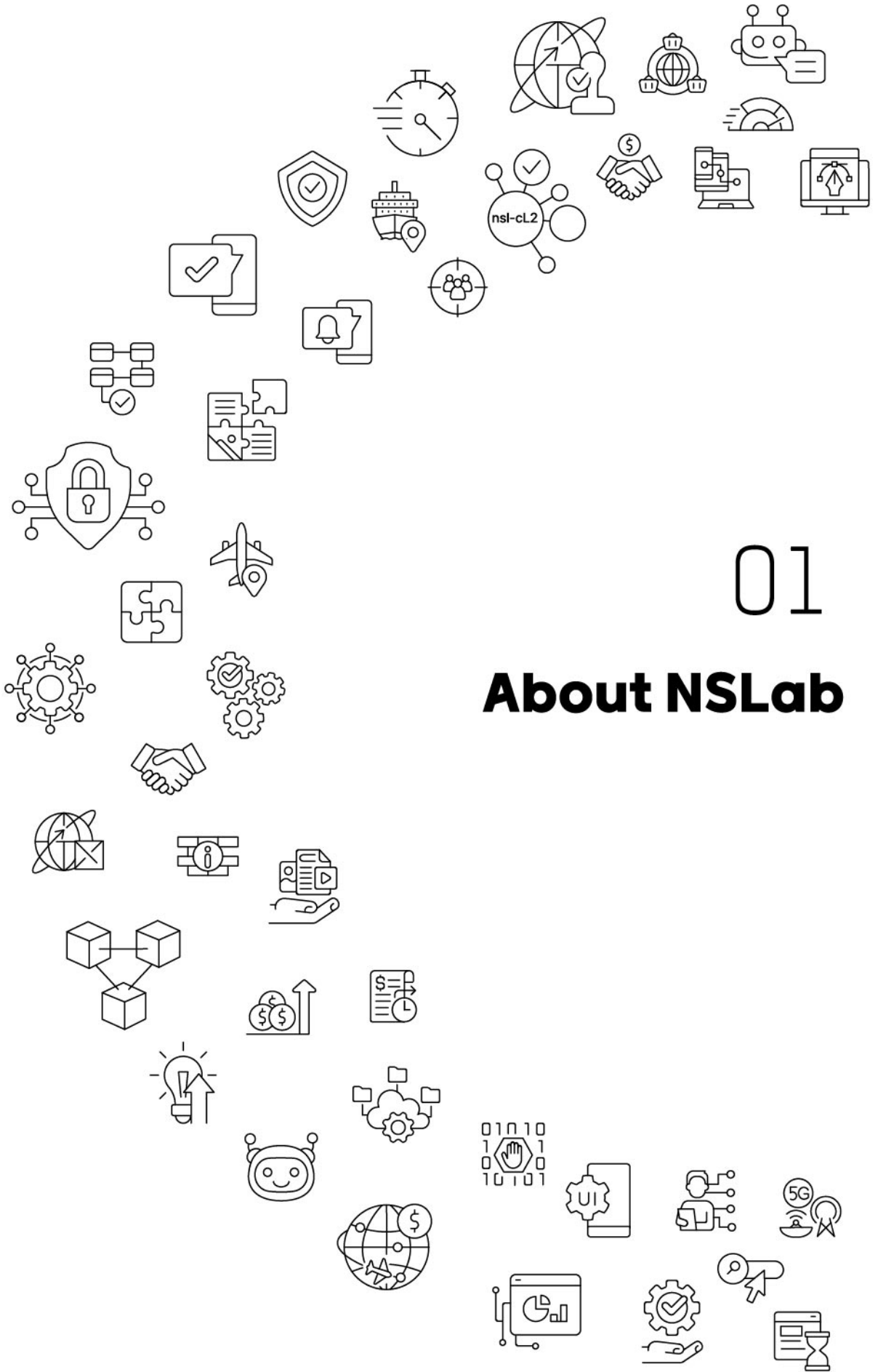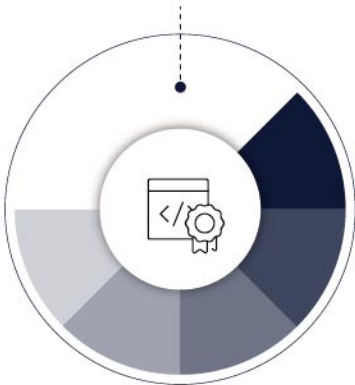## Our Vision

Developing technology with respect for customers and creating technological value based on trust.
" Never ever give up "

Our Goal

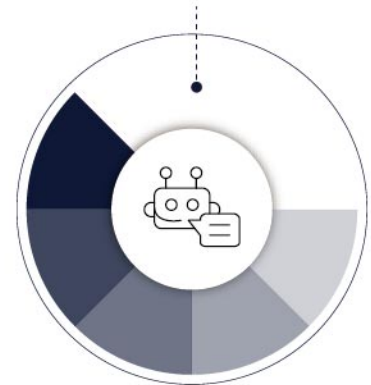NSLab Inc. aims to provide creative and fundamental solutions to IT-related problems and advanced technologies that surpass customer expectations for diverse countries.

Trust-Based Creative Technology Value

The art of sincerity

Precise description of value

Responding with honesty

Company Motto

Create value with precise, sincere, and honest S/W techniques

Honesty

Sincerity

Precision

CEO Message

CEO **Dong-Seong Kim**

NSLab Inc., originating from a university research laboratory, is a start-up that collaborates with more than 130 alumni from research labs worldwide.
Together, we design the future and create innovative technologies for mutual growth.

" Never ever give up "

CEO's Work Experience

2022.01-Present	2022.09-Present	2022.06-Present	2003.03-Present	2019.03-2022.02
NSLab Inc.	National Research Foundation of Korea/ Defense ICT Group (IITP)	ICT Convergence Research Center, Kumoh National Institute of Technology	School of Electronic Engineering, Kumoh National Institute of Technology	Industry-Academic Cooperation Foundation, Kumoh National Institute of Technology
CEO	National Research Headquarter Expert Member/ PM (Director)	Director	Professor	Director
Ph.D., Seoul National University (Real-time Systems, Industrial Blockchain)	Defense & Security Convergence and Planning / Defense Logistics and Metaverse	Grand ICT Research Center/ Priority Research Center	Director of Joint Research Institute for Defense System	Overall in charge of Industry -Academic Cooperation (including R&D Special Zone Project)

2015.02-2018.08	2017.08-Present	2015.03-Present	2019.01-Present
KIT Convergence Research Center	Naval Vessel Technology Research Institute/ Ministry of National Defense/CIO/Ministry of Science and ICT/National Research Foundation of Korea (2021.02-Present)	Senior member, IEEE and ACM	Korean Institute of Communications and Information Sciences (Civil-military IT Convergence Society)
Director	Advisory Committee Member	Committee Member /Board Member	Vice President/ Society Chairman
Research and National Project Planning	Engineering Innovation/ Improvement of Industry-Academic Cooperation Foundation (Ministry of Science and ICT)	IEEE/ACM AFCEA	Planning and Enhancing Exchanges for Defense and Military Projects

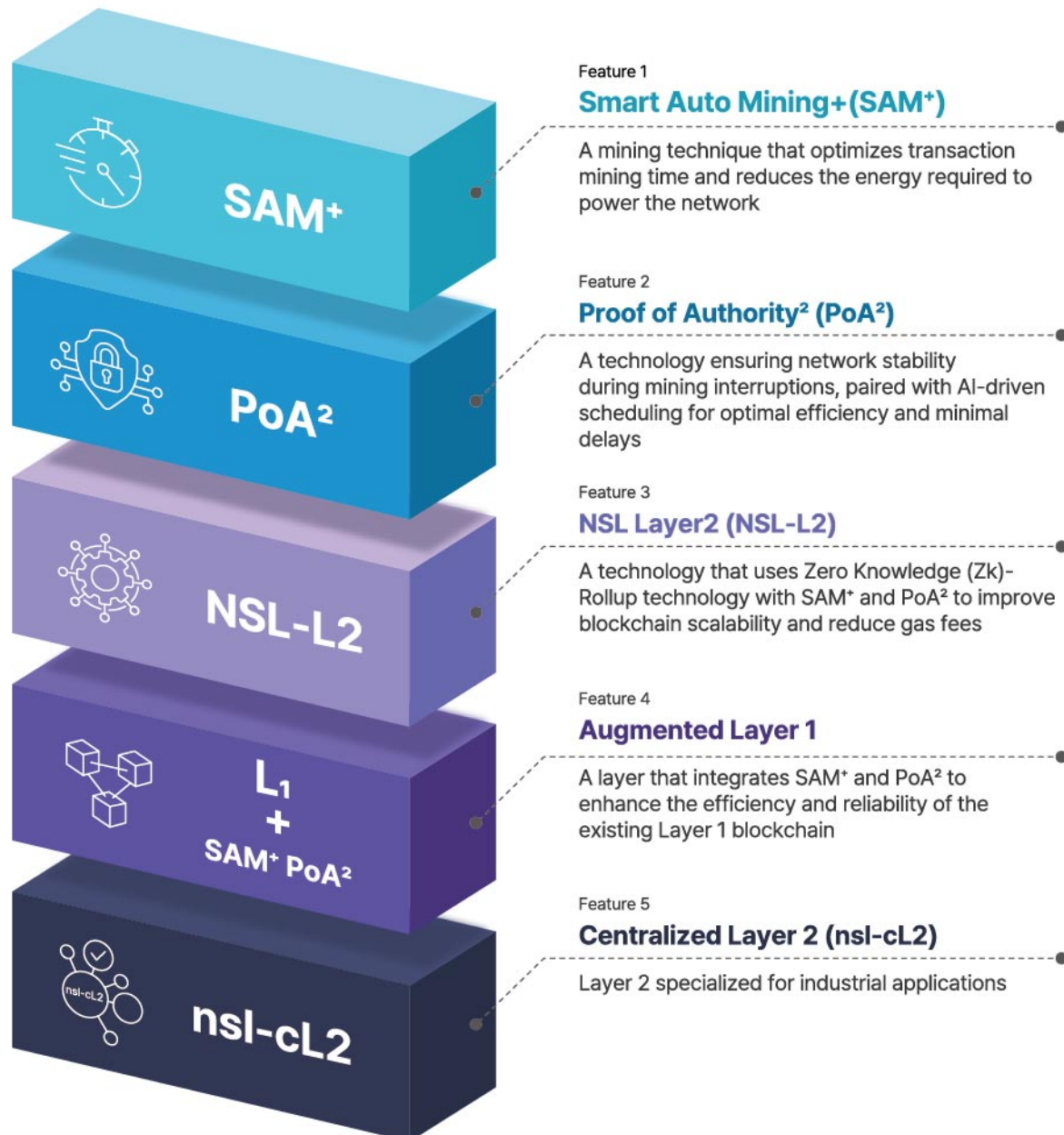| 2013-Present	2007.12-2009.02	2003.02-2005.02	1994.08-2003.02
ICTC(2018-Present), ICUFN (2019-Present), IEEE WFCS, IEEE ICC 2023, etc.	Department of Computer Science, U.C Davis	ECE, Cornell University	Engineering Research Center for Advanced Control and Instrumentation, Seoul National University
Workshop Chair, PC/TPC Member	Visiting Professor	Full-time Researcher	Associate/Senior Research Engineer
International Journal Editorial Board Member, etc.	Research on Real-time Software Technology	Research on Real-time Wireless Networks	Nuclear DSC and Factory Automation Software Projects

02

Products
and Services

Pure Chain

Pure Chain

A blockchain ecosystem with techniques to solve issues related to decentralization, security, scalability, and gas fees

Improved Performance over Traditional Blockchains

Utilize advanced technologies to address blockchain challenges (decentralization, security, scalability, high gas fees) and provide a real-time environment.

SAM+

PoA²

NSL-L2

L₁ + SAM⁺ PoA²

nsl-cL2

Feature 1
Smart Auto Mining+(SAM⁺)
A mining technique that optimizes transaction mining time and reduces the energy required to power the network

Feature 2
Proof of Authority² (PoA²)
A technology ensuring network stability during mining interruptions, paired with AI-driven scheduling for optimal efficiency and minimal delays

Feature 3
NSL Layer2 (NSL-L2)
A technology that uses Zero Knowledge (Zk)-Rollup technology with SAM⁺ and PoA² to improve blockchain scalability and reduce gas fees

Feature 4
Augmented Layer 1
A layer that integrates SAM⁺ and PoA² to enhance the efficiency and reliability of the existing Layer 1 blockchain

Feature 5
Centralized Layer 2 (nsl-cL2)
Layer 2 specialized for industrial applications

※ 1. Integrating Machine Learning with Proof-of-Authority-and-Association for Dynamic Signer Selection in Blockchain Networks
※ 2. Smart Auto Mining(SAM) for Industrial IoT Blockchain Network
※ 3. Proof-of-Authority-based Secure and Efficient Aggregation with Differential Privacy for Federated Learning In Industrial IoT
※ 4. Proof-of-Authority-and-Association Consensus Algorithm for IoT Blockchain Networks

Pure Wallet

Pure Wallet All-in-One Offline Blockchain Mobile Wallet
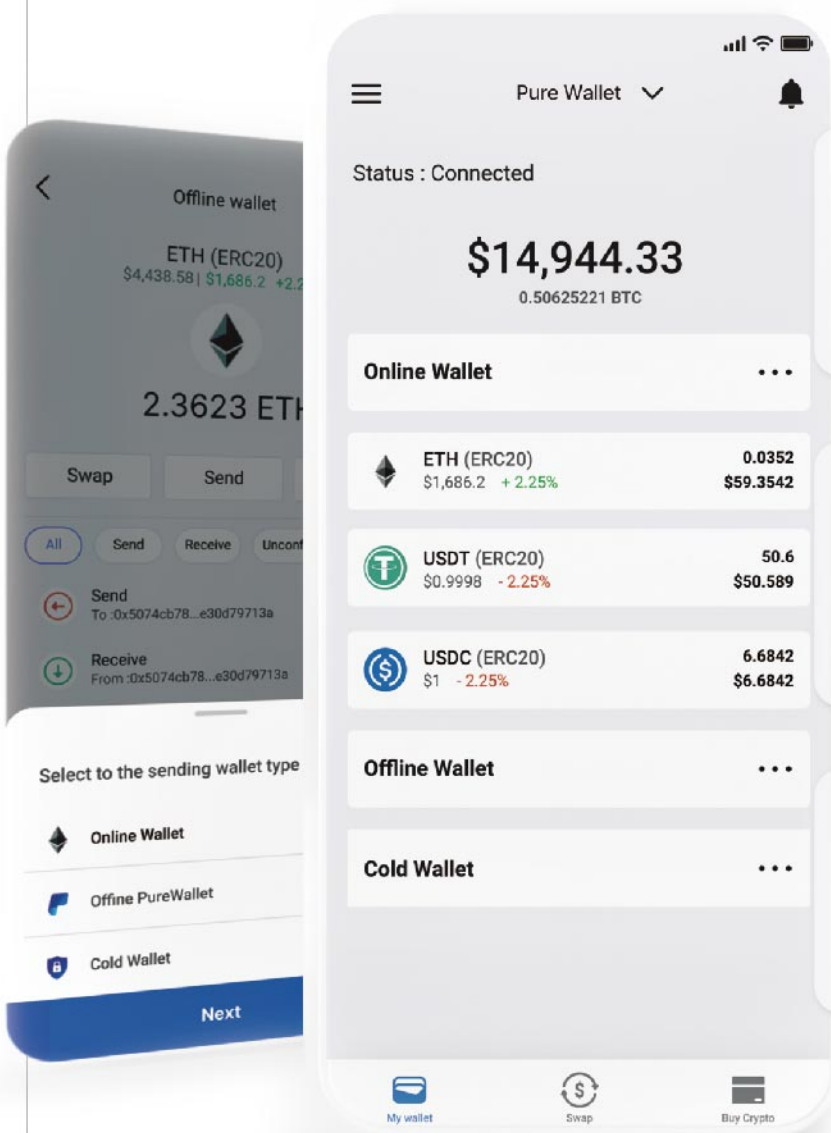
Effective Payment Process

Provide a more efficient and streamlined payment processing system with lower transaction costs using our exclusive offline blockchain technology.
Suitable for micropayments, bulk retail, and payments requiring high security.

Offline Mobile Electronic Wallet

Enable access to modern financial services even in limited infrastructure.
Empower emerging countries economically through offline banking functionality, providing them with the opportunity to enter the global digital economy.

Feature 1
Enhanced Hot Wallet

Strong security and smooth payments with offline tokens

Feature 2
Offline Wallet

The first successful offline cryptocurrency solution for e-commerce, PoS, and new markets with no gas fee
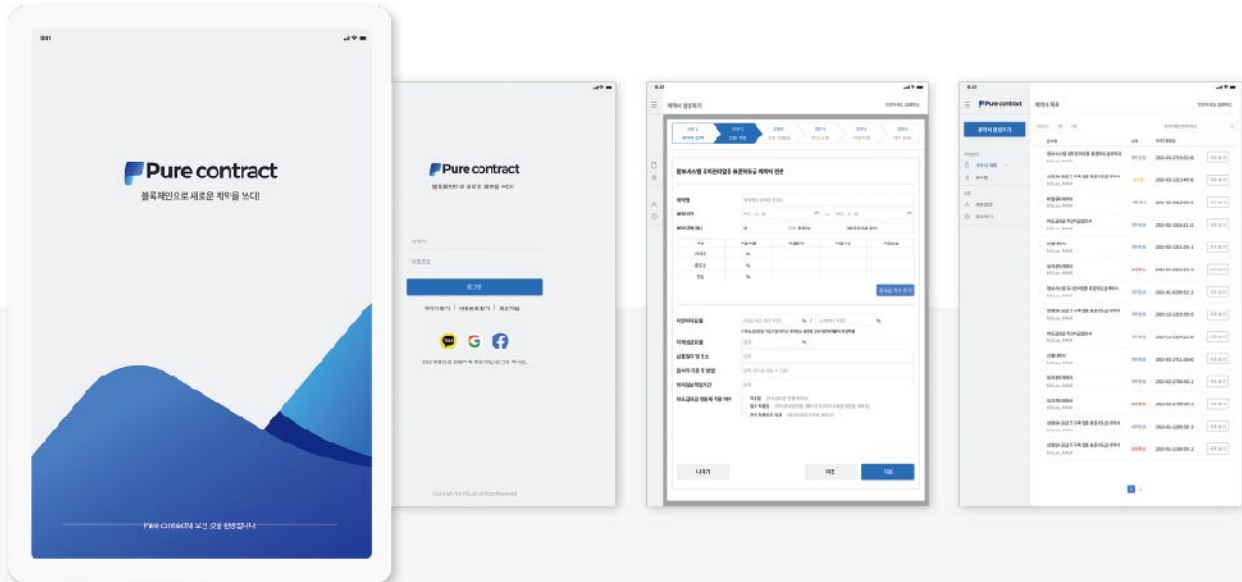
Feature 3
Hardware-Free Cold Storage

A secure, streamlined, and intuitively designed solution

※ 5. Blockchain Side Implementation of Pure Wallet(PW): An Offline Transaction Architecture
※ 6. AI Model Stability in Industrial IoT Intrusion Detection: Leveraging the Characteristics Stability Index

Pure Contract

Pure Contract Future-Ready Contracts : Automated and Secure

Feature 1
Blockchain-Based Contract Automation

Smart Contracts and IPFS ensure secure, decentralized, automated contract creation and management

Feature 2
Transparent and Fair Negotiation

Cross-approval features enable equitable and trustworthy contract finalization

Feature 3
Tamper-Proof Verification

Advanced hash algorithms protect contract integrity and prevent unauthorized modifications

Technical Features

01 Convenient Automated Contract Creation
Users can generate contracts effortlessly by entering key details, with formats based on the Fair Trade Commission's standard templates and future support for international standards.

02 Efficient Automatic Calculations
The system automatically calculates essential contract elements, such as payment amounts and contract durations, saving time and reducing potential errors.

03 Collaborative and Equitable Contract Finalization
With a cross-approval process, both parties can collaboratively edit and finalize documents, ensuring fair and transparent agreement terms.

04 Blockchain-Backed Security
The platform's tamper-proof verification, powered by blockchain and advanced hashing algorithms, guarantees trustworthiness and secure contract management.

Pure Certificate

Pure Certificate Secure Authentication, Ensuring Trust beyond Tampering

Create Reliable Certificates Anytime, Anywhere

Access the free Pure Certificate platform online and enjoy secure, stable, blockchain-backed certificate creation.
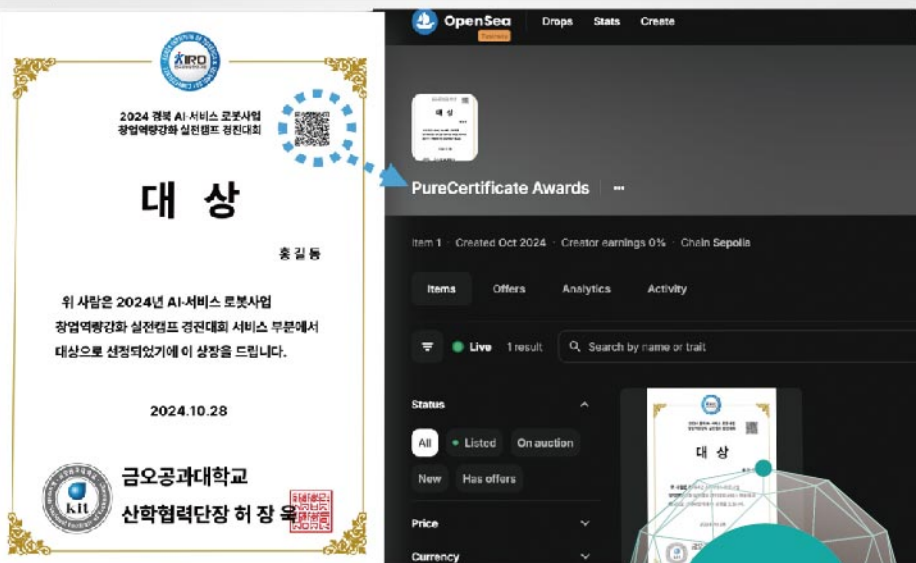
Blockchain-Verified Authenticity

Protect certificates from tampering with encrypted storage and authenticity verification via blockchain technology.

Effortless Certificate Design

Simply input details, upload logos and signatures, and preview professional certificates instantly—no extra formatting needed.

Templates for Quick Customization

Choose a template, personalize it, and download your blockchain-secured certificate as a PDF.

Feature 1
Data Protection
Fast and efficient encryption and decryption are achieved through two-way encryption, with data protection enhanced by security level settings
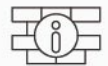
Feature 2
Original File Metadata
Guarantees the original file's authenticity through metadata based on the block hash algorithm

Feature 3
Forgery Detection
Forgery detection based on the perceptual hash algorithm

Smart Contract

DAPP

Private Network

| Certificate Transmission | Result of Integrity Verification | Request Mining | Mining Hash Value & Consensus Algorithm | Output Results of Integrity Verification & Mining |

Webpage
Enter Certificate Item

Generate Certificate(PDF) &
Verification Integrity

Blockchain Network
Private Blockchain

※ 7. Leveraging quantum blockchain for secure multiparty space sharing and authentication on specialized metaverse platform

Pure Voting

Pure Voting Transparent and Fair Voting System

Secure Data Management

Addresses voter concerns about privacy and ensures anonymity for the fairness of voting.
Pure Voting converts and stores the votes through NSLab's blockchain hash algorithm, making data forgery impossible.

Rapid Result Derivation

Multiple computer nodes connected to the network maintain and update the distributed ledger simultaneously. Parallel processing and real-time documentation shorten voting result processing, with network participants collaborating for swift outcomes, boosting efficiency and accuracy of the voting system.

Feature 1
Offline Electronic Voting

Secure voting in a beacon-based offline environment

Feature 2
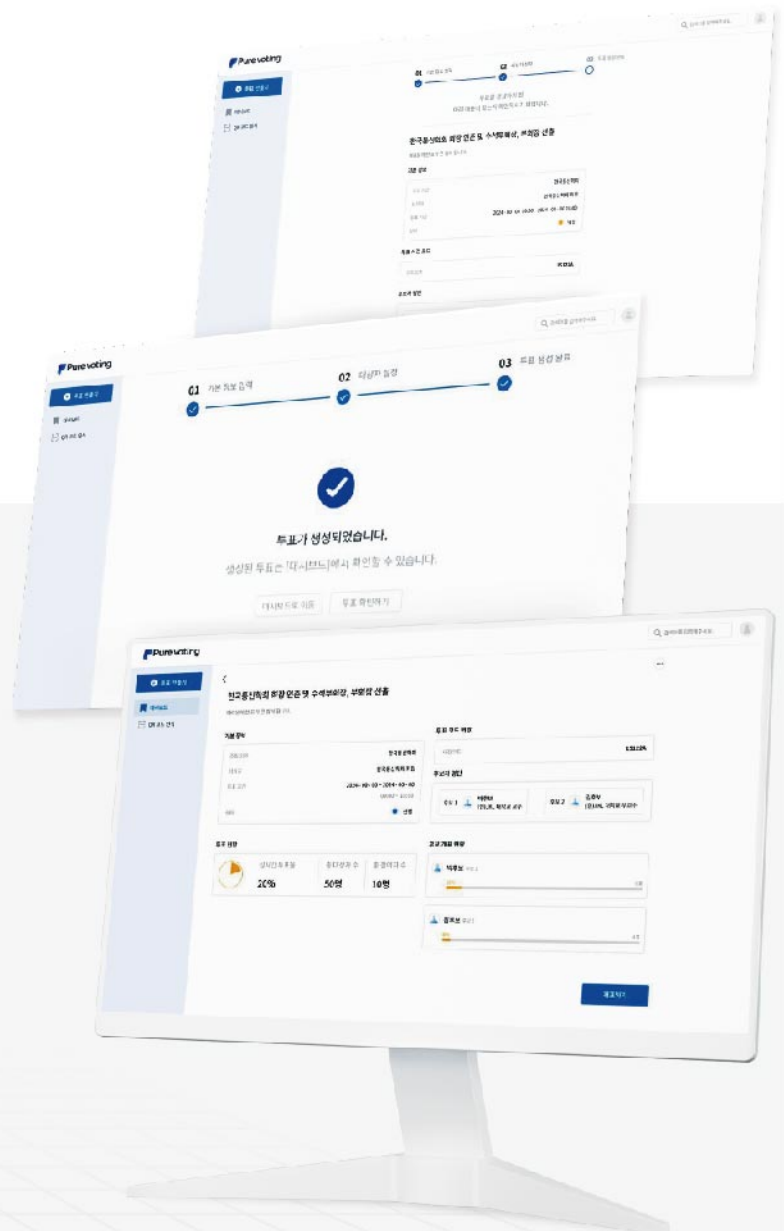### Reliable Offline Tokens

Enhanced reliability of voting data through blockchain offline transactions

Feature 3
Hybrid Blockchain

Enhanced reliability through a private blockchain, preservation of voting results through a public blockchain

※ 8. Pure Voting(PV): An Offline Voting Algorithm

Pure Edge

Pure Edge   Fail-proof Resilience with Pure Edge

Seamless Failover and Redundancy

01   Ensures uninterrupted service with multi-layer architecture

02   Primary Line fails, the system automatically switches to the Backup Line powered by IPFS

03   Both lines fail, the system transitions to Offline Mode

Enhanced Data Security with Pure Wallet

01   Integration with Pure Wallet, a blockchain-powered solution that secures data during offline transactions

02   Leverage smart contacts and encryption to ensure sensitive data remains protected and accessible only to authorized users

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Feature 1
Multi-Layer Resilience
3-layers of architecture : Primary Line, Backup Line (IPFS), Offline Mode (Pure Wallet)

Feature 2
Decentralized Data Integrity
Data cannot be lost or tampered with, even during failures

Feature 3
Low Latency and Rapid Failover
Fast failover times (20-30ms), ensuring seamless transitions between redundancy layers

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Primary Line   >   **IPFS-based Backup Line**   >   **Offline Mode**

Pure Wallet

• Fast Failover (<30ms)   • Decentralized Backup via IPFS   • Secure Offline Transactions

Pure Ticket / Media / Pet

Pure Ticket

Feature 1
Blockchain Security
Decentralized management with NFT verification

Feature 2
AI-powered Protection
Advanced scalping prevention and fraud detection

Feature 3
Efficient Operations
Streamlined ticketing process for venues and events

AI Protection
- Scalping detection
- Fraud prevention

Smart Booking
- NFT-based Ticket
- Real-time Validation

Pure Chain Network
- Secure ticket records
- Decentralized storage
- Smart contract integration

※ 9. PureNFT: A Blockchain-Based Ticketing System with Lightweight AI for Scalping Prevention

Pure Media

Copyright Checks Using Metadata
Conducts audio similarity checks by extracting unique metadata from audio files and comparing them.

Disclosure of User Metadata
Blockchain-based metadata disclosure of audio uploaded by users allows users to see the history of modifications and changes to their audio, ensuring audio transparency and determining the time of composition.

Audio Uploader → Upload audio → **Detection Module**: Generate metadata ⟫⟫ Match the hash ⟫⟫ Similarity

→ **NO** → Store audio to Database → Record URI and audio hash to blockchain
→ **Yes** → Reject audio

Database ⟷ **Decentralized Music Platform**: Content Distribution / Metadata Management / Discovery and Recommendation ⟷ **Blockchain Network**

Feature 1
Similarity Check
Similarity check based on audio metadata

Feature 2
Private Blockchain
Enhancing integrity through metadata storage on private blockchain while saving gas fees.

Feature 3
Web-Based Data Disclosure
Enhanced transparency through the disclosure of block data on a private blockchain

※ 10. HADES: Hash-Based Audio Copy Detection System for Copyright Protection in Decentralized Music Sharing

Pure Pet

Feature 1
Blockchain Security
Decentralized record management for enhanced data protection

Feature 2
Integrated Platform
Comprehensive solution for pet healthcare management

Feature 3
Community Focus
Connected ecosystem of pet owners and veterinarians

User Interface
- Appointment Management
- Health Screening Support
- Pet Community Access

Core Platform Features

Smart Booking
Streamlined appointment system

AI Recognition
Preliminary health screening

Community
Pet owner & vet network

AI Integration
Disease recognition system

Data Security
Blockchain-secured records

Community Platform
Connect with professionals

PureChain Network
- Secure medical records
- Decentralized storage
- Smart contract integration
- Multi-clinic compatibility

Technical References

References

1. Integrating Machine Learning with Proof-of-Authority-and-Association for Dynamic Signer Selection in Blockchain Networks, D.-S. Kim, R. Syamsul, ICT Express, 2024

2. Smart Auto Mining(SAM) for Industrial IoT Blockchain Network, I. S. Igboanusi, Allwinnaldo, R. N. Alief, M. R. R. Ansori, J.-M. Lee, D.-S. Kim, IET Communications, 2022

3. Proof-of-Authority-based Secure and Efficient Aggregation with Differential Privacy for Federated Learning in Industrial IoT, M. A. P. Putra, R. N. Alief, S. M. Rachmawati, G. A. Sampedro, D.-S. Kim, J.-M. Lee, Internet of Things, 2024

4. Proof-of-Authority-and-Association Consensus Algorithm for IoT Blockchain Networks, D.-S. Kim, I. S. Igboanusi, L. A. C. Ahakonye, G. O. Anyanwa, ICCE 2025

5. Blockchain side Implementation of Pure Wallet(PW): An offline Transaction Architecture, I. S. Igboanusi, K. P. Dirgantoro, J.-M. Lee, D.-S. Kim, ICT Express, 2021

6. AI Model Stability in Industrial IoT Intrusion Detection: Leveraging the Characteristics Stability Index, L. A. C. Ahakonye, C. I. Nwakanma, J.-M. Lee, D.-S. Kim, Journal of Korean Insititute of Communications and Information Sciences, 2024

7. Leveraging Quantum Blockchain for Secure Multiparty Space Sharing and Authentication on Specialized Metaverse platform, E. A. Tuli, J.-M. Lee, D.-S. Kim Scientific Reports, 2024

8. Pure Voting(PV): An Offline Voting Algorithm, I. S. Igboanusi, R. N. Alief, R. R. Ansori, Allwinnaldo, J.-M. Lee, D.-S. Kim, APCC 222

9. PureNFT: A Blockchain-Based Ticketing System with Lightweight AI for Scalping Prevention, G. A. Haryadi, A. Zainudin, J.-M. Lee, D.-S. Kim, ICCE 2025

10. HADES: Hash-Based Audio Copy Detection System for Copyright Protection in Decentralized Music Sharing, M. R. R. Ansori, Allwinnaldo, R. N. Alief, I. S. Igboanusi, J.-M. Lee, D.-S. Kim, IEEE Trransactions on Network and Service Management, 2023

Intellectual Property

Type	Title	Number	Type	Title	Number
patent	Blockchain-based Mobile Electronic Wallet System	10-2643418(KR)	Patent (Pending)	Offline Voting Service Method Using Blockchain and Its System (duplicate)	PCT/KR2023/016024
patent	Blockchain-based Data Sharing Method for Enhancing Reliability and Security of Distributed Systems	10-2307973(KR)	Patent (Pending)	Blockchain-Based Mobile Electronic Wallet System	PCT/KR2021/015676
patent	Beacon-based Chat Service System using MQTT	10-1863284(KR)	Patent (Pending)	Auction Method and System for Tracking and Managing a Supply Chain of Non-Fungible Token (NFT)-Based Fisheries	10-2023-0064870(KR)
patent	User Device and its Control Method	10-2051539(KR)	Patent (Pending)	Metaverse Inventory System	10-2022-0009947
patent	Methods for Encryption and Decryption Content	10-2154737(KR)	Trademark	Pure Wallet	97631618(US)
patent	User Terminal Device and its Display Method	10-2183448	Trademark	Pure Wallet	40-2175766(KR)
Patent (Pending)	Proof-of-Authority Method for High-Trust Blockchain Network	10-2024-0090171(KR)	Trademark	Pure Chain(Class 42)	238010(US)
Patent (Pending)	Proof-of-Authority Method for High-Trust Blockchain Network	PCT-KR2024-010241	Trademark	Pure Chain(Class 36)	238009(US)
Patent (Pending)	Blockchain-based Mobile Electronic Wallet System	18287182(US)	Trademark (pending)	P(Class 36)	40-2024-0091512(KR)
Patent (Pending)	Electronic Wallet System with a Method for Split Offline Tokens for Cryptocurrency Access Using Blockchain	10-2024-0069046(KR)	Trademark (pending)	P(Class 42)	40-2024-0091514(KR)
Patent (Pending)	Blockchain-Based Offline Voting Service Method with Enhanced Security and Its System	10-2023-0138385(KR)	Trademark (pending)	P(Class 09)	40-2024-0091507(KR)
Patent (Pending)	Offline Voting Service Method Using Blockchain and Its System	10-2023-0064875(KR)			

03

Collaborations

Collaborations

Partner companies

• Korea

[ICT Convergence Research Center]

[CJ LIVE CITY]

[Kumoh National Institute of Technology]

[Ino-on]

LIG Nex1

[LIG Nex1]

[LDS linux data system]

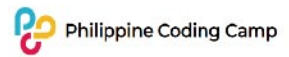[Gumi Information high school]

• International

[Qualcomm(USA)]

[Cognitgo(USA)]

[TrigoPi(Israel)]

[Philippine Coding Camp(The Philippines)]

[Polly Nwoke & Co.(Nigeria)]

[ekotek(Vietnam)]

[iSmartUrus Pte Ltd(Malaysia)]

[Primakara University(Indonesia)]

Certificates / Awards

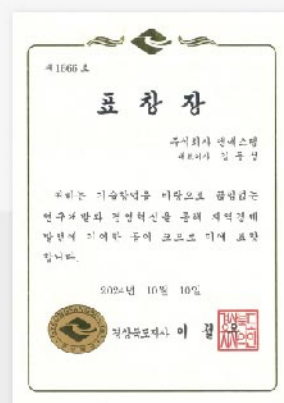[INNOPOLIS Research Institute Spin-off Company]

[Advanced Technology Enterprises]

[Certified R & D Department]

[Excellent Information Security Technology]

Collaborations

International Cooperation

International Network Status

USA

1570 Batavia Street, Orange, California (92867), USA

Nigeria

Estate Surveryors and Valuers, Suite 14, 2nd Floor, Hill Top Plaza (Main) Wuse Zone 4, Abuja, Nigeria

The Philippines

5F Phinma Plaza, 39 Rockwell Drive, Rockwell Center, Makati, Philippine

International Joint Research and Development Based on Blockchain and Metaverse

Imo State, Nigeria : Collaborating on an international exhibition project

BIU, University of Ilorin, Nigeria : Completed agreement for joint development of technology based on CREATIVIA

Hosted an international Metaverse workshop (2022.05.25-2022.05.26)

$1 million contract for international joint development of blockchain technology and realization of Metaverse-based space (USA : MetamonkeyAI, Cognitgo)

Joint development and sales agreements with companies in Nigeria, the Philippines, Indonesia, and Vietnam
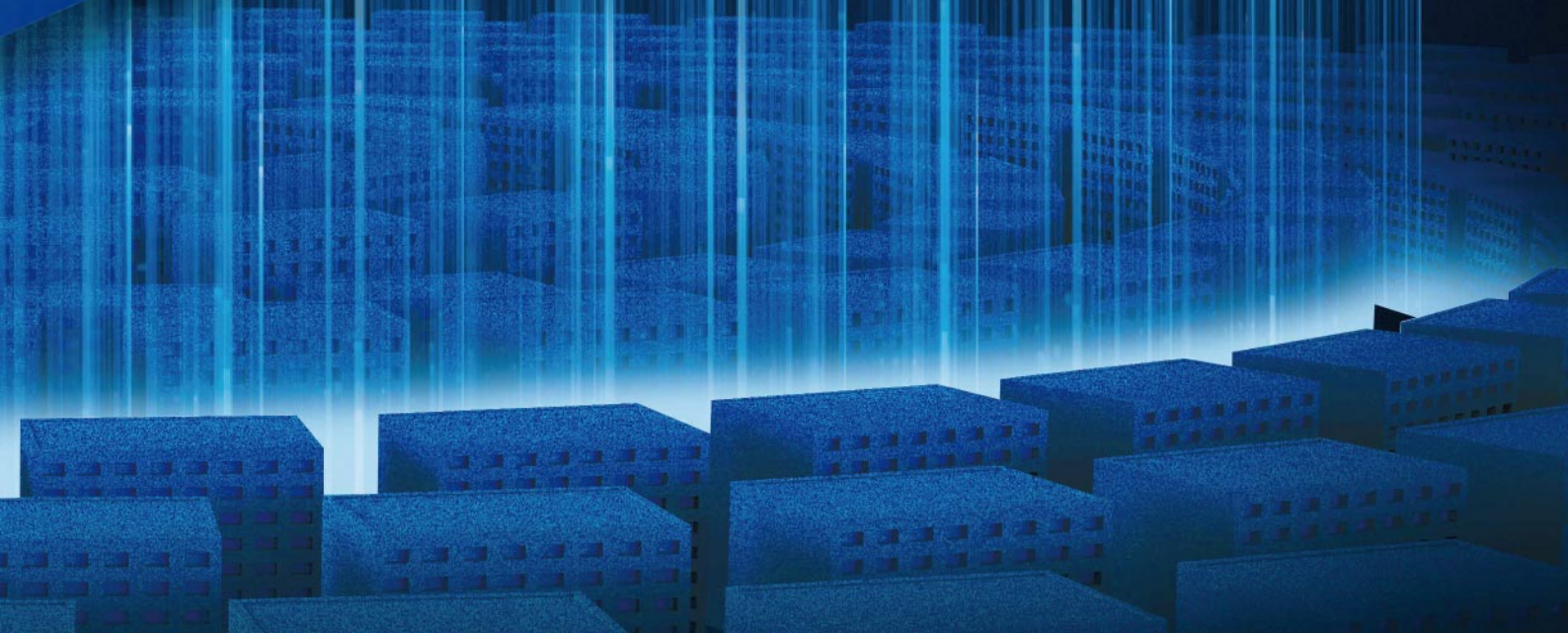
International Network Status

Cognitgo (USA)

Polly Nwoke&Co. (Nigeria)

TrigoPi Ltd. (Israel)

Philippine coding camp (Philippine)

ekotek(Vietnam)

iSmartUrus(Malaysia)

Telkon Univ.(Indonesia)

NS LAB
NETWORKED SYSTEMS LABORATORY

Pure Edge

Pure Certificate

Pure Voting

Pure Media

Pure Ticket

Pure Pet

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