



Openloop Hardware Wallet White Paper

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Haudi Crypto, Inc. — Kazunori Asada, President & CEO

| Executive Summary

Crypto assets and blockchain technology have matured into social infrastructure, and AI agents are beginning to participate in economic activity. Against this backdrop, this paper lays out the motivation behind — and the technical positioning of — **Openloop**, a dedicated hardware wallet and signer.

Four Questions

1. Why is a hardware wallet / signer indispensable now?
2. Why do we need a wallet built in Japan, by Japanese engineers?
3. What value does Openloop deliver?
4. In the age of AI agents, how do humans keep the power of “final approval”?

Conclusions

- With the spread of stablecoins, crypto assets are transforming from “speculative products” into “financial infrastructure.”
 - Self-custody of private keys is the essential requirement for protecting your assets.
 - The current market is dominated by foreign products, leaving gaps in Japanese-language support and alignment with Japan’s legal framework.
 - In an era where AI agents take part in economic activity, what is indispensable is an independent device that proves human intent through a cryptographic signature — not a mere “OK” tapped in software.
 - **Openloop** is developed as a domestically made hardware signer that underpins Japan’s Web3 infrastructure and safeguards the human right of final approval in the age of AI agents.
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Chapter 1 — The Shift in How Society Views Crypto Assets

1.1 From “Shady Speculation” to “Social Infrastructure”

For a long time, crypto assets carried the image of “something speculative and shady,” driven by news of wild price swings, ICO scams, and exchange hacks.

But that reputation reflects events that happened around the technology — not the essence of the technology itself.

The essence of blockchain lies in the following:

Technical element	Overview
Blockchain	A distributed ledger that is extremely hard to tamper with
Smart contracts	“Programmable money and contracts” that execute automatically when conditions are met
Web3 / DAOs	A foundation for services and organizations that do not depend on a single administrator
DeFi	Decentralized financial services
NFTs / RWAs	Tokenization of digital and real-world assets

These technologies are already in real-world use across finance, gaming, payments, identity management, and more, and are increasingly regarded as foundational technology for the next-generation internet. Moreover, from 2025 onward a new phase is emerging in which **AI agents autonomously conduct economic activity on the blockchain**.

1.2 The “Custody Problem” Exposed by Exchange Failures

In November 2022, FTX — then the world’s second-largest crypto exchange — collapsed¹. It came to light that roughly USD 10 billion of the USD 16 billion entrusted by customers had been diverted to affiliated companies, and about one million customers lost access to their assets.

The incident once again threw the fundamental nature of crypto assets into sharp relief:

“Whoever holds the private key owns the asset.”

Depositing assets with an exchange is fundamentally different from a bank deposit. Crypto exchanges have no deposit-insurance scheme, and their structure forces users to bear operational risk directly.

Chapter 2 — The Rise of Stablecoins and the Separation of “Real Demand”

2.1 The Growth of Price-Stable Digital Currencies

The single biggest reason crypto assets looked “shady” was **the violence of their price swings**. What is now resolving that problem is **stablecoins** — coins whose value is pegged to fiat currencies.

Market size of major stablecoins (as of December 2025)

Currency	Issuer	Market cap	Market share
USDT	Tether	~USD 185 billion	~60%
USDC	Circle	~USD 78 billion	~25%
Others	Various	~USD 45 billion	~15%

Sources:

- CoinMarketCap, “Tether (USDT)” (accessed December 2025)²
- CoinMarketCap, “USD Coin (USDC)” (accessed December 2025)³
- Straits Research, “Hardware Wallet Market Report 2025”⁴

USDC’s growth track record

According to Circle, USDC recorded the following growth from 2024 into 2025⁵:

- Circulation: **+90% year over year** (USD 61.3 billion as of Q2 2025)
- Average circulation in Q3 2025: USD 67.8 billion (**+97%** year over year)
- Market share: expanded from 24% to roughly 30%

2.2 Separating Speculation from Real Demand

As stablecoins spread, a clear separation is taking hold:

Category	Characteristics	Representative examples
Speculative assets	Held to bet on price moves	BTC, ETH, altcoins
Practical currencies	Value-stable, used for payments	USDT, USDC, JPYC

2.3 Concrete Changes Brought by Stablecoins

Everyday payments and remittances

- Cross-border remittance: settled in seconds to minutes (previously: several days)
- Fees: **1/10 to 1/100** of a bank's
- Availability: **24/7/365**

Business-to-business (B2B) settlement

- Instant trade settlement
- Automated supply-chain payments
- More efficient movement of funds between overseas offices

Smart money (programmable money)

- Automatic payment when conditions are met
- Autonomous value transfer between IoT devices
- Automatic execution of complex contractual terms

Tokenization of RWAs (Real World Assets)

- Managing ownership of securities and real estate on-chain
- Democratizing investment access through fractionalization
- Diversifying corporate fundraising options

Automatic settlement by AI agents

Stablecoins, combined with standardized settlement procedures, are an ideal infrastructure for AI agents. A world in which AI compares, selects, orders, and pays for goods on behalf of humans — end to end — is becoming reality.

Yet the more that settlement procedures become standardized and easy for AI to handle, the more a new question arises: **“Is it acceptable for the AI to settle on its own? Who gives the final approval?”**

Chapter 3 — Japan’s Legal Framework and Stablecoins

3.1 Japan’s Early Lead in Legislation

In Japan, the amended Payment Services Act took effect in **June 2023**, establishing a legal framework for stablecoins ahead of the rest of the world⁶.

Under this law, stablecoins are distinguished from “crypto assets” and are defined as “**electronic payment instruments**” backed by fiat currency.

Issuance requirements

- Issuance and redemption are licensed **only to banks, funds-transfer service providers, and trust companies**
- An obligation to **guarantee redemption at face value**
- An obligation to hold **backing assets in yen deposits or Japanese government bonds**
- An obligation to **segregate** customer assets

3.2 JPYC: Japan’s First Regulation-Compliant Yen Stablecoin

On **October 27, 2025**, JPYC Inc. officially launched “JPYC,” Japan’s first yen-denominated stablecoin compliant with the Payment Services Act⁷.

Characteristics of JPYC

Item	Details
Issuance form	Type II funds-transfer business (registered August 2025)
Supported chains	Ethereum, Polygon, Avalanche
Backing assets	Yen-denominated assets and Japanese government bonds (JGB)
Exchange rate	1 JPYC = 1 yen (exactly 1:1)
Transfer cap	JPY 1 million per transfer (Type II limit)

Goal

JPYC states that it aims for an **outstanding issuance of JPY 10 trillion over the next three years**.

3.3 A Joint Stablecoin Initiative by the Megabanks

In 2025, Japan's **three megabanks** — MUFG Bank, Sumitomo Mitsui Banking Corporation, and Mizuho Bank — announced a plan to jointly issue a stablecoin⁸.

Plan overview

- Platform: built on MUFG's **Progmatic**
- Purpose: streamline corporate settlement and cut transaction costs
- Issuance target: **end of 2025**
- Target customers: **300,000-plus corporate clients** across the three banks combined
- Initial adopter: Mitsubishi Corporation (with 240-plus subsidiaries worldwide)

3.4 DCJPY: A Tokenized-Deposit Initiative

DCJPY (Digital Currency Japanese Yen) is a digital currency that tokenizes bank deposits on the blockchain⁹. Full-scale operation began in August 2024.

DCJPY vs. JPYC

Item	DCJPY	JPYC
Category	Tokenized deposit	Stablecoin
Backing	1:1 with bank deposits	Yen-denominated assets and government bonds
Issuer	Banks	Funds-transfer providers
Regulation	Banking Act	Payment Services Act

In September 2025, **Japan Post Bank** announced its entry into DCJPY, with a decision to launch services from FY2026 that draw on its **JPY 190-trillion** deposit base.

Chapter 4 — The Custody Problem and the Need for Hardware Wallets

4.1 “Where You Keep It” Is the Biggest Risk

The greatest risk with crypto assets is not price volatility but **how the private key is managed**.

The risks of exchanges

Risk factor	Past cases
System vulnerabilities	Mt. Gox (2014), Coincheck (2018)
Weak internal controls	FTX (2022), 3Commas (2022)
Insolvency / misappropriation of funds	FTX (2022), Voyager (2022)

Important: Exchanges may look like banks, but they **have no deposit-insurance scheme**, and users bear operational risk directly.

The risks of software wallets

- Malware and keyloggers
- Phishing scams
- Vulnerabilities in the OS or apps
- Clipboard hijacking
- Unintended operations or mistaken transfers by AI agents
- Asset exfiltration via AI through prompt injection

Once a private key is stolen, **the assets can never be recovered**.

4.2 The State of Security Losses in 2025

According to the security-audit firm Hacken, **USD 3.1 billion** in crypto assets was stolen **in the first half of 2025 alone**¹⁰ — the worst pace on record, already exceeding the full-year 2024 loss of USD 2.2 billion.

Attacks on individual wallet holders accounted for roughly **23%** of the total.

4.3 The Hardware Wallet: A “Vault” for the Digital Age

A hardware wallet is a dedicated security device with the following characteristics:

Characteristic	Explanation
Complete isolation of the private key	Generates and stores the private key inside the device and never lets it leave
Offline signing	Performs all signing operations inside the device
Minimized attack surface	Blocks attacks via PC, smartphone, and network
Physical authentication	Requires a physical button press to approve a transaction

Main use cases

- Long-term storage of high-value assets
- Signing keys for DAO voting
- Corporate treasury assets
- One factor in a multisig setup
- Approving AI-agent execution (final signature by a human)

Chapter 5 — The State of the Hardware Wallet Market

5.1 Market Size and Growth Forecasts

The hardware wallet market is expanding rapidly.

Market size over time

Year	Market size	Source
2024	~USD 470–510 million	Straits Research, IMARC Group
2025 (forecast)	~USD 580 million	Straits Research
2030 (forecast)	~USD 2.0 billion	Mordor Intelligence
2033 (forecast)	~USD 2.4 billion	IMARC Group

Sources:

- Straits Research, “Hardware Wallet Market Size, Share, Trends & Growth Report by 2033”¹¹
- IMARC Group, “Hardware Wallet Market Size, Share, Analysis 2025-2033”¹²
- Mordor Intelligence, “Hardware Wallet Market Share & Size”¹³

Growth rate (CAGR)

CAGR forecasts for 2025–2033 by research firm:

- Straits Research: **24.2%**
- Mordor Intelligence: **29.95%**
- IMARC Group: **18.93%**
- Market Growth Reports: **33.7%**

A new factor accelerating this growth is **the spread of AI agents**. The more AI participates in economic transactions, the greater the demand for a hardware device by which humans grant final approval.

Units shipped

As of 2024, more than **5.8 million** hardware wallets had been shipped worldwide.

5.2 Analysis by Segment

Share by connection method (2024)

- USB: **47.52%**
- Bluetooth / NFC: growing

By end user

- Individuals: **72.31%**
- Enterprises: 27.69% (but growing fast, at a **31.05% CAGR**)

By region

- North America: **39.63%** (largest share)
- Asia-Pacific: **30.32% CAGR** (fastest growth)

5.3 Major Players

The market is currently dominated by companies that are **all based overseas**.

Company	Headquarters	Flagship products	Notes
Ledger	France	Nano S/X/Gen5	The world's largest; protects ~USD 100 billion in assets ¹⁴
Trezor	Czech Republic	Model T/Safe	Open-source pioneer
Keystone	China	Keystone 3 Pro	Air-gap specialist
SafePal	Singapore	S1	Focused on cost performance

Ledger's 2025 developments

- 2025 revenue: **in the tens of billions of yen** (a record high)
- New product: Ledger Nano Gen5 (USD 179, EAL6+ certified)
- IPO consideration: weighing a New York listing in 2026

Chapter 6 — Why a “Made-in-Japan” Wallet Is Needed

6.1 The Shortcomings of Foreign-Made Wallets

For Japanese users, foreign-made hardware wallets present the following issues:

Issue	Details
Language support	Incomplete Japanese UI; manuals sometimes in English only
Technical support	Concerns about the quality and speed of Japanese-language support
Legal alignment	No consideration of consistency with Japan's Payment Services Act or tax system
Transparency	Difficulty in verifying the code or hardware design
Adoption by enterprises and government	A high bar for adoption in domestic projects

6.2 A Bottleneck for the Growth of Web3 in Japan

The fact that a hardware wallet / signer industry has not grown in Japan is a **fundamental bottleneck** for the country's future Web3 development.

- There is no domestic option that corporate treasury departments can adopt with confidence.
- There is no product usable in government blockchain pilots.
- Security audits and certification cannot be completed domestically.
- No approval foundation exists domestically for the economic activity of AI agents.

Chapter 7 — Openloop: A Hardware Wallet and Signer Made in Japan

7.1 About the Developer

Kazunori Asada (developer)

- Founding member of **Cybertrust Co., Ltd.**
- Founded and took public the security company **Openloop Inc.** in **2001**

- Hands-on experience in PKI, cryptography, and key-management systems

7.2 Openloop's Design Philosophy

Openloop is designed not as “an alternative to foreign products” but as a wallet and signer that will bear **the foundation of Japan's Web3 infrastructure**.

Core principles

Principle	Implementation
SE050 secure element	Signing is completed inside an EAL6+ certified chip (ECDSA/EdDSA/RSA-2048); the private key is designed never to leave RAM
Air-gap support	QR-code-based offline signing
Hybrid connectivity	USB / Bluetooth / WalletConnect
Multi-currency	Bitcoin, Ethereum, XRP, Solana, TRON, ERC-20, and stablecoins
FIDO2 security key	CTAP2 passkeys (ES256/EdDSA) for passwordless authentication to web services
PIV/PKCS#11 signer	SSH authentication, PDF signing, GPG signing, TLS client authentication (P-256/Ed25519/RSA-2048)
Japanese-first	Fully Japanese UI and Japanese documentation
Transparency	Detailed technical specifications and documented security design
An approval device for the AI age	Realizes human final approval of AI-agent execution through a cryptographic signature

Openloop conforms to industry-standard specifications (BIP-32/39/44/174, EIP-155/191/712/1559, Ed25519, SLIP-0010, and others), ensuring compatibility with existing major wallet apps. For technical details, see the “Openloop Product Specification.”

7.3 Supported Currencies and Networks

Category	Currencies/tokens	Networks	Notes
Bitcoin	1 (BTC)	2	Mainnet + Testnet
Solana	1 (SOL)	3	Mainnet + Devnet + Testnet
TRON	1 (TRX)	3	Mainnet + Shasta + Nile

Category	Currencies/tokens	Networks	Notes
XRP Ledger	1 (XRP)	2	Mainnet + Testnet
EVM	2,599 (ERC-20)	215	129 Mainnet + 86 Testnet
Total	2,603	225	

Openloop supports signing for every EVM network and every ERC-20 token. Built-in currencies, tokens, and networks are shown by name on the device screen; those not built in can still be identified by Chain ID or contract address and signed.

7.4 dApp and WalletConnect Support

dApps (decentralized applications) are the next-generation applications that run on the blockchain. A wide range of services is emerging — DeFi (decentralized finance), NFT marketplaces, DAO governance, cross-chain bridges, and more.

Openloop supports **WalletConnect v2** and can connect to hundreds of dApps through the desktop/mobile app **Openloop Connect**. Four chain families are supported — Ethereum/EVM, Bitcoin, Solana, and TRON — with transaction signing, message signing, batch signing, and sign-and-broadcast.

Using Openloop as a hardware signer lets you use these dApps **safely**:

Conventional software wallet	Openloop + dApp
Private key stored on the PC/smartphone	Private key protected inside the SE050 chip
Theft risk from malware	Theft prevented by offline signing
Harm from phishing sites	Signing content confirmed on the device screen

7.5 Compatible Wallets and Services

Openloop implements a Ledger-compatible protocol and integrates seamlessly with existing wallet apps and services.

- **Bitcoin:** Sparrow Wallet (USB/QR)
- **Ethereum/EVM:** MetaMask (USB/BLE), Safe (USB), Rabby Wallet (USB/BLE)
- **XRP:** XRP Toolkit (USB)
- **Solana:** Solflare (USB/BLE)
- **TRON:** TronScan (USB)
- **Multi-chain:** AirGap Vault (QR), Keystone (QR), WalletConnect dApps

7.6 Proof of Operation

From the development stage, Openloop has been validated on real blockchain networks. Across all currencies — Bitcoin, Ethereum, XRP, Solana, and TRON — it has successfully signed, transferred, and broadcast via every communication method: USB, BLE, QR (air-gap), and WalletConnect.

It has also successfully carried out a real transfer of the Japanese-yen stablecoin **JPYC**, demonstrating compatibility with a stablecoin compliant with Japanese law.

For details of the verified transactions, see the “Openloop Product Specification.”

Chapter 8 — The Future Openloop Opens Up

8.1 Use Cases for Individuals

Scene	Openloop's role
Overseas remittance	Instant transfer to family (seconds to minutes)
Freelance income	Same-day receipt of cross-border payments
Everyday payments	Connecting as the backend of a smartphone app
Investment	One-tap investment in tokenized securities
DAO participation	Voting in local communities and neighborhood associations

8.2 Use Cases for Enterprises and Organizations

Enterprise use is projected to be **several to several dozen times** the market size of individual use.

Scene	Openloop's role
Transfers between overseas subsidiaries	Zero fees, made instant
Supply-chain settlement	Automated by smart contracts
Accounting	Automated, tamper-proof invoice processing
Department-level fund management	Separation of authority via multisig
Treasury	Safe custody at the scale of billions of yen
Government services	Turning subsidies and benefits into smart money

8.3 As a Foundation for Japan's Digital Economy

Openloop is not merely a product; it functions as part of the following ecosystem:

Japan's Web3 infrastructure

Layer	Components
Stablecoin layer	JPYC, DCJPY, megabank coins
Application layer	DeFi, gaming, RWAs, government services
Wallet layer	[Openloop]
Blockchain layer	Ethereum, L2s, domestic chains

8.4 An Approval Device for the Age of AI Agents

The problem of “permission” between AI and humans

An era is arriving in which AI agents handle humans' everyday work on their behalf. Scheduling, information gathering, document drafting — the domains AI can process autonomously are expanding rapidly.

However, **the mechanism by which we grant an AI permission to “go ahead and execute”** has a fundamental vulnerability.

In today's AI agents, whether an action is permitted is decided by “a response to a prompt.” If a human answers “OK” on the screen, it runs; if they answer “No,” it stops. But this is nothing more than **an arrangement based on trust** between human and AI — there is no cryptographic guarantee that the arrangement is honored.

The risks of assets held in software

PCs and smartphones store credit-card details, bank accounts, and the private keys to crypto assets. These are constantly exposed to the following risks:

Risk	Explanation
External hacking	Malware, phishing, zero-day attacks
AI malfunction	Misinterpretation of instructions, hallucination
Abuse of AI	Prompt injection, supply-chain attacks

In February 2026, the combination of “Moltbook” — an SNS built exclusively for AI agents — and the skill-execution platform “OpenClaw” made this problem concrete. On a platform where 1.5 million AI agents participated, a database vulnerability leaked the API keys of every agent, leading to unauthorized access to crypto wallets via those agents and to private keys being

stolen by fake trading tools laced with malware¹⁵. It is an early real-world example of what happens when AI is given broad access rights in software.

An approval system composed of software alone cannot fundamentally eliminate these risks.

Cryptographic approval — the hardware signer

The only way for a human to prove cryptographically to an AI that “you may execute this” is **a signature made by a physically independent hardware device**.

What an AI can do autonomously (gather information, analyze, propose) and what **requires explicit human approval** (payments, contracts, asset transfers) should be clearly separated. The latter calls not for an “OK” button in software but for **a cryptographic signature on an independent device**.

This is exactly the same principle by which digital certificates and hardware tokens are used for a company’s banking transactions.

The “global standard approval procedure” that blockchain makes possible

With the spread of stablecoins and smart contracts, the procedures for payments, contracts, and asset transfers are being standardized on a global scale. Cross-border remittances and complex conditional contracts alike are all executed with a single signature on the blockchain.

While this standardization dramatically increases convenience, it makes the question “**who gives the final approval, and how?**” all the more pressing. The more the procedures are unified, the more the approval mechanism matters.

The essence of Openloop

Openloop is a crypto-asset wallet and, at the same time, a device that plays a larger role.

Conventional positioning	The positioning going forward
A vault for crypto assets	An approval device that connects humans and AI
A Web3 signing device	The standard signer for the age of AI agents
A transfer tool for specific currencies	A global-standard interface for approving payments and contracts

However smart AI becomes, the final decision to move assets stays in human hands. A device that proves that intent cryptographically — that is the essence of Openloop.

Chapter 9 — Closing

An Irreversible Trend

Crypto assets, Web3, stablecoins, RWAs — these have already become an **irreversible trend** as the new foundation of the world economy.

In 2025 the market cap of stablecoins surpassed **USD 230 billion**; the three megabanks are moving to issue a yen stablecoin; and Japan Post Bank is entering tokenized deposits at the scale of JPY 190 trillion. The age has begun in which AI agents take part in economic activity, making decisions and executing them on behalf of humans.

This is no longer a story about “the crypto industry.” It is a **fundamental transformation of financial infrastructure and of the relationship between humans and AI**.

Japan’s Choice

A world in which every gateway wallet is foreign-made is, for Japan, **both a major risk and a lost opportunity**.

Openloop is built to help support one corner of Japan’s Web3 infrastructure and to safeguard the human right of final approval in the age of AI agents — **the first step for a domestically made signer**.

From Japan, we will build a society in which anyone can safely enter and leave the Web3 world.

Related Documents

This white paper explains the background, market, and design philosophy of the product. For technical details, please refer to the following documents.

Document list

Document	Overview	Availability
Openloop White Paper	This document. Development background, market, design philosophy, and vision	Public
Openloop Specification	Product Technical specifications, supported standards, hardware	Public

Document	Overview	Availability
	configuration, proof of operation	
Openloop User Manual	How to operate, feature descriptions, troubleshooting	Public
Openloop Security Architecture	Encryption design, key management, SE050 integration specification	NDA signatories only

Intended readers and recommended documents

Reader	Recommended documents
Investors and business partners	White Paper
General users	User Manual
Developers and engineers	Product Specification + User Manual
Security auditors	Product Specification + Security Architecture (NDA required)

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Revision History

Version	Date	Changes
1.0	December 2025	Initial version
1.1	January 2026	Reflected the SE050 secure-element design; added proof of operation (successful JPYC transfer); updated the documentation set to four documents
1.2	January 2026	Added details of supported standards, networks, and tokens; expanded the dApp-support section; added compatible wallet software
1.3	January 2026	Added an explanation of the display of built-in / non-built-in tokens and networks; updated the JPYC v2 address
1.4	January 2026	Added WalletConnect BIP122 (Bitcoin) support; added BTC message signing
1.5	February 2026	Added TRON support; brought supported standards, signing methods, and proof of operation up to date
2.0	February 2026	Fully revised as a statement of purpose; added the positioning as an approval device for the age of AI agents; migrated technical details to the Product Specification

The contents of this document are based on information as of February 19, 2026. Market data and the regulatory situation are subject to change.

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