NON-AGENTIC AI GOVERNANCE SINGAPORE
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A12 [P+N] Deterministic Black Box

Engineering Monograph on Hardware-Enforced Non-Agentic AI Governance Architecture

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MISSION

We Innovate Save Lives™ — every piece of technology developed must serve human flourishing, preserve dignity, and protect every living life. The mission does not change at the bedside, at the frontier, or across 40 light-minutes of signal delay.

I. The Authority Drift Problem

Authority Drift describes the progressive normalisation of autonomous machine decision-making in environments where human sovereignty must remain absolute. In conventional AI architectures, software-defined governance boundaries can be silently eroded through configuration changes, model updates, or runtime fine-tuning. The NAIGE framework identifies this as the primary failure mode of probabilistic AI systems in high-stakes settings.

The NAIGE architecture resolves Authority Drift by shifting the entire governance perimeter from software policy to hardware-enforced constitutional constraint. Every consequential action must pass through physical silicon gates that cannot be reconfigured, bypassed, or overridden by software-layer commands. The system defaults to Mechanical Stillness — the P-LIFE 1.00™ safety constant — whenever human authorisation is absent or system integrity is compromised.

II. The ABC+2S+H™ Constitutional Framework

At the heart of the NAIGE system lies the ABC+2S+H™ Framework, which maps ethical governance principles directly onto physical hardware logic. This five-layer constitutional architecture ensures that every stage of data processing, deliberation, and action remains under deterministic human control.

A — Analysis Layer

Non-diagnostic pattern matching with no autonomous inference capability. Telemetry processing is entirely decoupled from biometric identity through FPPA Voxelization. The system utilises a 905nm LiDAR sensor with parallel hardware comparators that instantly translate raw point clouds into anonymised 96-cell voxel occupancy grids. Output is limited strictly to kinematic Center of Mass (CoM) velocity vectors — pure geometry, stripped of all identifying information.

B — Bridging Layer

Connects sensor data to established clinical pathways using zero probabilistic weighting. No ranking, no nudging, and no default selection is applied. The A7 Bridge Layer (Patent No. 10202602213U) coordinates multi-channel vector translation across national infrastructure pillars without introducing any algorithmic preference. All translations remain deterministic and auditable.

C — Clinical Options

The system presents exactly three unranked, equal-weight options to the human operator. No option is visually or computationally emphasised over another. This eliminates subtle algorithmic steering — commonly called nudging — that characterises conventional AI decision support systems.

+2S — Sacred Pause™

A hardwired cognitive forcing function implemented through downstream silicon counters operating on a 1 kHz master clock domain. A mandatory hardware hold of 25 to 1,000 milliseconds is enforced between option presentation and any subsequent action. This is not a software sleep command — it is a physical timing lock that prevents automated or runaway execution at the circuit level.

+H — Human Decision

Every consequential action requires an explicit human commit via the Tiger .1x Key™ — a tripartite access latch demanding simultaneous validation of three independent physical factors:

- Iris Scan — biometric identity verification

- Cryptographic Token — digital possession proof
- Kinetic Foot Pedal — physical presence and intent

If human authorisation is absent or incomplete, the system triggers an immediate NULL / VOID state, forcing all connected actuators into permanent Mechanical Stillness under the P-LIFE 1.00™ safety constant.

DOCTRINE	*AI observes · AI advises · AI builds · The human decides — always, finally, and without exception.*

III. Privacy-by-Physics: The 3ZEROS™ Protocol

To ensure absolute privacy in sensitive clinical environments, the NAIGE architecture employs the 3ZEROS™ Protocol: Zero Camera, Zero Audio, Zero Cloud. This is not a software privacy policy — it is a hardware-enforced structural constraint that eliminates entire classes of data vulnerability at the physical sensing layer.

- Zero Camera — 905nm LiDAR replaces optical cameras; no facial or biometric image ever exists.
- Zero Audio — No microphones are deployed; no voice or ambient audio is captured.
- Zero Cloud — Air-gapped edge processing; no external data transmission occurs.

Because FPPA Voxelization occurs at the hardware level — before any data enters the processing pipeline — biometric identity is stripped away instantly and permanently. An elder who falls in a monitored ward is detected and assisted without any camera footage, audio recording, or cloud transmission ever existing.

IV. The Terminal Hardware Gate: A12 [P+N] Black Box

The A12 [P+N] Deterministic Black Box (Patent No. 10202602023X) serves as the final physical enforcement layer within the NAIGE governance stack. Operating entirely offline in an air-gapped, tamper-evident enclosure, it acts as the primary gatekeeper for all kinetic outputs.

P Layer — Sensing and Voxelization

The P Layer handles all physical sensing under the 3ZEROS™ Protocol. Raw 905nm LiDAR point clouds enter the unit and are immediately transformed into anonymised voxel grids by parallel hardware comparators. Only kinematic CoM velocity vectors pass onward to the deliberation pipeline. No biometric data ever exists within the system memory.

N Layer — Deterministic Deliberation Pipeline

The N Layer operates on a rigid 1 kHz master clock domain with zero asynchronous safety-critical paths. The pipeline proceeds through six sequential stages:

- Input Processing — validated kinematic vector ingestion
- Sacred Pause™ Gate — 25–1,000 ms hardware timing lock
- Tiger .1x Key™ Authentication — tripartite physical authorisation check
- Safety Kernel Enforcement — ±0.05 mm kinematic constraint verification
- FSM Deterministic State Machine — formal state transition execution
- Hardware Output Gate — final physical release to actuators

Orange Code™ 110% Cap and Sovereign Brake™

Two core mechanisms prevent the system from exceeding its constitutional boundaries. The Orange Code™ 110% Cap physically throttles the system to 1.1× of its baseline computing power through hardwired circuit design — the system physically lacks the spare computational cycles required to infer, hallucinate, or execute any function beyond its defined task set.

The Sovereign Brake™ engages when the system detects a persistent, unauthorised remote cyberspace write attempt. The U7 One-Shot Sequencer cuts power to the LDO computing rails, invalidating the master clock token and locking all physical actuators into permanent stillness. Because this is a physical power severance at the circuit level, it cannot be bypassed, overridden, or tricked by software-layer attacks.

Immutable Accountability: Enhanced WD117 Ledger

The Enhanced WD117 Ledger provides forensic accountability through a Commit-to-Finality Path:

Event Data → SHA-3-512 Hash → Post-Quantum Signature → A10a Hardware Seal → WORM Memory Commit → OTP Fuse Finality

Once an entry passes OTP fuse finality, modification is architecturally prevented by the physical properties of the storage medium.

A12 Hardware Specifications

Parameter	Specification
Enclosure	300 × 200 × 100 mm
Ingress Protection	IP67
Mechanical Standard	MIL-STD-810H
Master Clock Domain	1 kHz (hardware-synchronous)
Sacred Pause™ Range	25 – 1,000 ms
Kinematic Constraint	±0.05 mm (FSM Safety Kernel)
Power Input	12 – 24V DC
Orange Code™ Cap	1.1× baseline FLOPS (hardware-throttled)
LiDAR Sensor	905 nm, parallel hardware comparators
Voxel Grid	96-cell anonymised occupancy grid
Ledger Hash	SHA-3-512 + Post-Quantum Signature
Storage Finality	OTP Silicon Fuse (unalterable)
Tamper Protection	Tamper-Evident Seals + Air-Gap
Auth Gate	Tiger .1x Key™ — Iris + Token + Kinetic Pedal

V. NAIGE Architecture Component Register

Code	Component	Patent	Function
B1	Nightingale's Eyes Care™	10202601257Q	Primary 3ZEROS™ LiDAR + Thermal voxel sensing + Sacred Pause Gate
A12	A12 Deterministic Black Box	10202602023X	Terminal P+N governance: voxelization, 1kHz deliberation, FSM Safety Kernel

A13	Supreme Guardian (M Series)	10202602026W	Top-level constitutional authority; P-LIFE 1.00™ mandate enforcement
A13a	Medical Mobility Enclosure	10202602143W	KCL hardware-enforced constraints + A10a Root-of-Trust
A13b	Sensing Limb / Ceiling Voxel	10202602087W	905nm LiDAR + IMU, 3ZEROS™ horizontal scanning
A13c	Clinical Robotic Platform	10202602205U	B2B arm: jerk-limit KCL + safe-stop mechanism
A7	Bridge Layer / Translation Hub	10202602213U	Multi-channel SITL vector translation; pRegister routing
A11	Cyberspace / Defence Bridge	10202601915Y	Air-gapped IT/OT translation; 53-min delay tolerance
WG-B1	Humanitarian Field Kit	10202602208V	IP67, solar-assisted; zero-cloud execution under Gift Doctrine

VI. Strategic Patent Portfolio

The NAIGE architecture is secured through a comprehensive sovereign patent portfolio filed with the Intellectual Property Office of Singapore (IPOS). The portfolio encompasses 106+ patents covering Frameworks 1.0 through 19.0, hardware enforcement mechanisms, privacy-by-physics protocols, and clinical safety systems.

No.	Patent Ref.	Title / Description	Filed
A1	10202601296R	Non-Agentic AI 2.0 Constitutional Governance & Privacy-Preserving Sensing	19/04/2026
A7b	10202601608U	Sacred Pause · Sovereign Brake · Drift-Control Architecture	13/05/2026
A9	10202601744X	Constitutional Hardware Enforcement Architecture (CHEA)	22/05/2026
A10a	10202602021T	Deterministic Non-Agentic Hardware-Enforced Governance Platform	13/06/2026
A12	10202602023X	A12 Sovereign Appliance — Terminal Deterministic Black Box	14/06/2026
A13	10202602026W	Unified Deterministic Non-Agentic Governance Core	15/06/2026
A13a	10202602143W	Non-Agentic Medical Mobility Enclosure with KCL & A10a Root-of-Trust	23/06/2026
A13b	10202602087W	Deterministic Voxel-Based Spatial Monitoring Apparatus	18/06/2026
A13c	10202602205U	OEM B2B Shell with KCL, Voxel Sensing & Hardware-Enforced Governance	26/06/2026
A7	10202602213U	A7 Bridge Layer Translation Hub — Standalone Deployment Hub	26/06/2026
B1-WG	10202602208V	Humanitarian Field Kit Shell (IP67, Solar-Assisted)	26/06/2026
A(12)P+N	10202602223T	A(12) Deterministic Black Box — Enhanced WD117 Immutable Ledger	28/06/2026

VII. Deployment and Regulatory Pathway

The NAIGE architecture is anchored to a structured regulatory rollout pathway beginning with the Singapore Health Sciences Authority (HSA) and scaling outward to global humanitarian and deep-

space domains. The architecture deliberately prioritises domestic sovereign approval as the foundational reference point for international adoption.

Phase	Timeline	Milestone	Regulator	Status
Phase 1	Q1 2027	HSA Class B SaMD Certification	HSA Singapore	In Progress
Phase 2	Q2 2027 – Q2 2028	Toa Payoh Hearth 12-Month RCT	MOH / HSA	Planned
Phase 3	Q3 2028 – Q3 2029	NUH Clinical Validation Trial	NUH Ethics / HSA	Planned
Phase 4	Q4 2029	IMDA MGF Framework Alignment	IMDA Singapore	Planned
Phase 5	2030	WHO Humanitarian Deployment	WHO / UN	Strategic Target
Phase 6	2031+	Deep Space Non-Agentic Sentinel	NASA / ESA / UNOOSA	Conceptual

NOTE *All clinical performance targets (fall detection rate, decision accuracy) are design intent specifications pending HSA Class B SaMD validation protocol. No hardware prototype has been submitted for regulatory assessment as of Q2 2026.*

VIII. From Eldercare to Deep Space

While deeply anchored in eldercare and clinical robotics, the NAIGE architecture scales universally across application domains. The same hardware-enforced governance principles that protect patient dignity in a hospital ward extend naturally to orbital and deep-space environments.

Clinical Deployment: Nightingale's Eyes Care™

In clinical settings, the NEC™ (B1) framework detects elder falls without compromising patient dignity or relying on cloud computing infrastructure. The A13c Clinical Robotic Platform operates under a Kinematic Constraint Layer (KCL) that enforces strict jerk-limit boundaries and safe-stop mechanisms. The Elder Dignity Score (EDS) serves as a qualitative endpoint alongside clinical safety metrics.

Humanitarian Deployment: WG-B1 Field Kit

The WG-B1 Humanitarian Field Kit Shell (Patent No. 10202602208V) provides an IP67-rated, solar-assisted edge computing platform for humanitarian and disaster relief operations. The system supports zero-cloud execution under the Gift Doctrine for WHO and UN target domains.

Deep Space Extension: Non-Agentic Sentinels

In deep-space environments, the framework extends to Non-Agentic Sentinels for orbital and interplanetary use. Utilising the same 3ZEROS™ LiDAR tracking principles, these platforms map asteroids, comets, and orbital debris purely by geometric kinematics. The Sovereign Brake™ ensures these systems remain Flashlights rather than Hunters, with hard-coded orbital fences preventing any autonomous course-change or strike capability.

IX. Conclusion and Strategic Outlook

The Non-Agentic AI Governance Architecture represents a fundamental departure from conventional AI safety approaches. Where existing frameworks rely on software policies, ethical guidelines, and probabilistic safeguards — all of which remain vulnerable to drift, bypass, and regress — NAIGE embeds governance directly into hardware silicon. The machine cannot usurp; it can only assist.

The architecture achieves three structural guarantees that no software-based system can provide:

- Deterministic Safety — every action follows a hardwired, formally verifiable state machine with no asynchronous pathways.
- Absolute Privacy — biometric identity is stripped at the physical sensor level before any data processing occurs.
- Immutable Accountability — every event is recorded in silicon fuses that cannot be altered by any party, under any circumstances.

PRINCIPLE	*The machine cannot usurp; it can only assist. The hand remains human — at the bedside, at the frontier, across 40 light-minutes of signal delay.*

X. Citation Register and Academic Foundation

Primary Citation

Koh, E. W. K. (2026). NAI 4.0™ Constitutional Framework. Non-Agentic AI Governance Singapore (ACRA T260229801). Patent SG020603109STW. NLB Legal Deposit Vault R260219-005 / R260302-007. Available at: https://non-agentic.ai

Patent Basis

IPOS SG020603109STW (parent) · Application 10202600902P · A-family divisionals A1–A13c · NLB vault references R260219-005 and R260302-007.

WISL™ Ebook Series

This document is WISL™ Ebook No. 71 in the We Innovate Save Lives™ constitutional knowledge base. The series covers NAI Frameworks 1.0–19.0, hardware enforcement mechanisms, clinical deployment protocols, and humanitarian governance architectures. For the complete register, see www.non-agentic.ai.

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- MBA — General and Strategic Management — Maastricht School of Management
- BSc — Industrial and Systems Engineering — University of Florida
- Independent Researcher — OCA Designation — NLB Vault Constitutional Anchor Route

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