

ZOYEL Physical AI for Health

How it works - the concept

Most health AI is built on what patients *say*. Zoyel is built on what patients *measure* - and on the trajectory of those measurements *over time*.

Two components make this possible: a physical diagnostic terminal at the point of care, and a national AI that learns from every encounter without ever centralizing patient data.



PART 1 - ZoyeMed 3.0: The Edge AI Terminal

What it is

ZoyeMed 3.0 is a self-contained Edge AI autonomous clinic and laboratory - the size of a large desk - that acquires over 120 clinical measurements simultaneously in a single 30-minute encounter. It needs no hospital, no specialist, no reliable internet connection. It can be operated by a community health worker under AI guidance. For advice, there is a human in the loop, where the clinical decisions including diagnosis and prescription are done by the doctor who joins remotely. However, in emergency situations and for wellness checks, it can perform well without a specialist - subject to the local regulatory position in the region where it is used.

Heart & Lungs <ul style="list-style-type: none"> · 12-lead ECG · Full spirometry (15+ parameters) · Digital Stethoscopy · Blood pressure, SpO₂, heart rate 	Laboratory (120+ tests) <ul style="list-style-type: none"> · Full blood count (22 parameters) · Biochemistry (35+ markers) · HbA1c, thyroid, cardiac enzymes and multiple other tests · Rapid tests: TB, dengue, malaria, HIV 	Examination <ul style="list-style-type: none"> · Dermoscopy · Otoscopy, fetal Doppler 	Context <ul style="list-style-type: none"> · Weight, height, BMI, body composition · Urine analysis (14 parameters) · Multilingual symptom history · All measurements time-synchronized
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<p>The problem with current health AI</p> <p>Diagnosis by dialogue AI assumes patients can accurately describe their own condition. They cannot - they forget, misinterpret, or simply cannot articulate what they feel.</p> <p>Snapshot thinking A single blood pressure reading or a one-time lab result tells you almost nothing. Disease is a direction, not a number.</p> <p>Confidence without data Most AI will produce an output even when the underlying data is unreliable. In a remote clinic, a dangerous guess is worse than silence.</p>	<p>How ZoyeMed solves it</p> <p>Physical ground truth ZoyeMed acquires objective measurements independently of what the patient says - ECG, blood panels, lung function, retinal images. Data, not description.</p> <p>Synchronised multi-variable capture All measurements are taken within the same timed window, producing a coherent clinical picture - not a scattered collection of unrelated readings.</p> <p>The Amygdala safety gate Before any AI inference runs, the system scores data quality across every modality. If inputs are insufficient, the system stays silent rather than producing a dangerous guess.</p>
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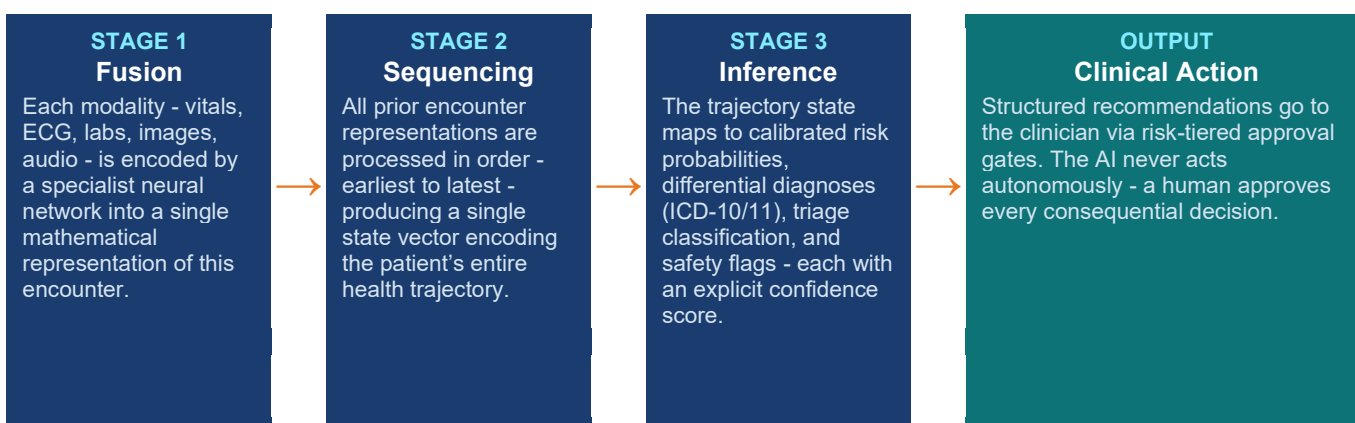
The Amygdala - why silence is a clinical signal

- 1. Data Gating:** Every measurement is scored for quality. The system computes a sufficiency score across all modalities. Only when enough high-quality data is present does inference proceed. When data is insufficient, the system flags it and requests remeasurement. It does not produce a low-confidence output. Silence is itself a clinically meaningful signal.
- 2. Anonymisation:** It converts all data into vectors and standardised outputs, anonymises and encrypts Personal Health Information so that personal data never leaves the local terminal. This ensures Data Sovereignty.
- 3. Triage:** The Amygdala senses distress for immediate referral and the local AI evaluates most processes locally to determine the next step - such as what information is needed for the clinical flow.

PART 2 - The Cortex: Longitudinal Multimodal Model + State Space Model

The central idea

A patient's health is not a number - it is a **direction**. An HbA1c of 6.2 means almost nothing in isolation. An HbA1c that has moved from 5.8 → 6.2 → 6.5 over 18 months tells you everything: this patient is accelerating toward diabetes. Zoyel's AI is built to see the direction, not just the number.



The State Space Model - national intelligence

The SSM is what allows the system to think at national scale - across millions of patients, across years of data - without any individual patient's records ever leaving the facility where they were created.

Each terminal learns from its own patients. What it shares upstream is not patient data - it is **what the model learned**: the mathematical adjustments to its weights. The national model aggregates these adjustments from thousands of terminals. The result is a national intelligence that has effectively learned from every encounter, without any of that data ever moving.

What this enables

Epidemic early warning

A cluster of terminals showing elevated fever, unusual respiratory patterns, and atypical lab distributions triggers an alert - weeks before hospital admissions rise.

Disease trajectory forecasting

The national model sees not just today's burden of diabetes in a region, but the direction and velocity of change - enabling planning years ahead.

Health equity monitoring

Continuous, near-real-time comparison of health outcomes across geographies and demographics - not a survey every five years.

Continuous learning

Every confirmed diagnosis and treatment outcome feeds back into model improvement. The system becomes more accurate as the network grows.

Why a State Space Model - and not a standard AI?

Standard AI models process a fixed moment in time. An SSM is designed specifically to hold and update a mathematical **state** - a compressed representation of everything that has happened - and update it efficiently as new information arrives. For health, this is the right architecture: a patient's current risk is a function of their entire history, not just today's readings. At national scale, the SSM holds the health trajectory of a population in its mathematical state, updating continuously across millions of lives. ***It is the difference between a photograph and a film.***

PART 3 - The Thalamus: Patient Layer & Closed-Loop Intelligence

The intelligence improves because of what happens after the visit

A clinical AI that only learns at the moment of an encounter and then stops is a snapshot system with extra steps. Zoyel's intelligence closes the loop - gathering data between visits, capturing outcomes, and feeding everything back into the model. The patient's phone becomes a continuous sensor. Every resolved case becomes a lesson.

Zoyel.Health - Patient App

- Full access to personal health records, test results, and clinical notes at all times
- Remote consultation with doctors - video, audio, or text
- Continuous monitoring via phone: self-reported symptoms, wearable inputs, activity and sleep data
- Medication reminders and adherence tracking
- Outcome reporting: how the patient responded to treatment feeds back into the AI
- Secure, encrypted - the patient owns their own longitudinal health record

Closed-Loop Intelligence

- Every resolved encounter - confirmed diagnosis, treatment response, follow-up result - re-enters the model as a training signal
- The next clinic visit updates the patient's trajectory vector with new measurements
- Self-reported data and app-based monitoring fill the gaps between visits
- The model does not sit frozen at a training checkpoint - it learns continuously from outcomes
- The more patients it sees, the more accurate it becomes: intelligence that compounds over time

The Feedback Loop

- Patient app → continuous monitoring data → SSM trajectory update
- Next visit → new physical measurements → LMM re-inference on updated trajectory
- Confirmed outcomes → model weight adjustment → federated learning round
- Improved national model → pushed back to edge terminals
- Result: a system that becomes more accurate the longer it runs - not a static product but a living intelligence

The Thalamus - governance, routing, and policy enforcement

Sitting beneath the visible applications, the Thalamus layer manages data residency, consent, audit, and the interface between edge terminals and national tiers. It enforces which data flows where, under what conditions, and with whose authorization. It is the architectural guarantee that the rules of data sovereignty are followed in practice, not merely stated in policy.

PART 4 - The Immutable Audit Trail: Accountability by Architecture

What is recorded

Every AI inference

What data was used, what model version produced the output, what confidence score was assigned, and what the clinician decided

Every approval and override

Every time a clinician approved, modified, or rejected an AI recommendation - with a reason code and timestamp

Every data quality gate

Every time the Amygdala suppressed output, flagged insufficient data, or escalated for remeasurement

Every federated learning round

What model update was submitted, by which terminal cluster, under which signed policy bundle

Every data access event

Who accessed what patient data, when, and under what authorisation condition

Why this matters

Tamper-evident by construction

Each log entry cryptographically references the previous one, forming a hash chain. Any attempt to alter a past record breaks the chain - detectable immediately.

Continuous process improvement

The audit trail is not just a compliance record - it is the data source for understanding where the AI is most and least reliable, where clinicians most often override it, and where the system needs calibration.

Parliamentary and judicial accountability

Every decision the national AI system has ever made can be reconstructed in full - including what data it saw, what it recommended, and what a human did with that recommendation.

Seven-year retention. Deletion via key destruction only - the record of deletion itself is preserved.

PART 5 - Zoyel.One: The Business Suite

A complete operational platform - so the system is self-sufficient

A clinical AI that works in isolation from the operational reality of a health facility is a pilot, not an infrastructure. Zoyel.One is the business and operational layer that makes the whole system self-contained - clinical workflows, human resources, finance, analytics, and collaboration in a single platform. Core services cannot live in a vacuum. Zoyel.One means a facility does not need any other piece of software to become operationally independent. It can also connect via API to existing hospital systems or government HMIS where those already exist.

<p>Clinical Workflows</p> <p>Configurable, trackable task and workflow management for every clinical process - from patient intake to discharge, referrals, follow-ups, and care plans.</p>	<p>HRM, CRM & Finance</p> <p>Manage staff, schedules, patient relationships, billing, and inventory - all within the same platform. No separate HR or accounting system needed.</p>	<p>GeoSpatial Analytics</p> <p>Real-time view of what is happening and where. Time-based and spatial visualization of clinical activity, disease burden, and resource utilization across facilities.</p>
<p>Business & Clinical Reporting</p> <p>Deeply customizable dashboards and reports combining inventory, productivity, clinical outcomes, and financial performance in a single view.</p>	<p>Web Presence & Collaboration</p> <p>Video consultation, secure chat, webinars, and a productivity suite - so the care team can collaborate without leaving the platform.</p>	<p>API Interoperability</p> <p>Connects to existing hospital information systems, government HMIS, insurance platforms, and third-party tools via standard APIs - no forced replacement of legacy infrastructure.</p>

HOW IT ALL CONNECTS

ZoyeMed 3.0 Edge Terminal

Acquires measurements. Runs LMM inference locally, offline, in real time. All raw patient data stays here - it never moves.

model learning only

State / Regional Hub

Aggregates model weight updates from many terminals. No patient records - only mathematical learning. Routes improved model back down.

model learning only

National SSM

Aggregates learning from the entire network. Produces epidemic signals, NCD forecasts, equity monitoring. No patient data reaches this level - ever.

The network grows smarter with every encounter - across every terminal, across the country - without any individual patient's data ever leaving the facility where it was created. **The intelligence is national. The data remains local.**

FIG. X: Federated Learning Governance Loop

