

NEAX DIGITAL PRODUCT PASSPORT



THE TRAILBLAZERS

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CONTEXT

THE PROBLEM

Strict U.S. **UFLPA regulations** require importers to prove the origin and labor history for every garment batch entering the market.

THE GAP

Factory compliance data is fragmented across paper declarations, ERPs, warehouse receipts, and isolated machine logs—making verification manual, slow, and prone to tampering.

THE SOLUTION

NEAX unifies supplier screening, IoT telemetry, AI anomaly detection, and Polygon blockchain proof into a single, audit-ready **Digital Product Passport (DPP)**.

PROJECT OBJECTIVES

02 - CONNECT

Link supplier → material batch → manufacturing order using an immutable, traceable Batch ID.

04 - VERIFY

Run rules, statistical and machine-learning detectors in parallel to flag production anomalies and mass-balance inconsistencies.

06 - PASSPORT

Combine supply-chain, production, verification and integrity evidence into a signed Digital Product Passport ready for compliance submission.

1 - SCREEN

Screen full supply chain (suppliers, material batches and logistics partners) against UFLPA restricted-entity lists at warehouse receiving.

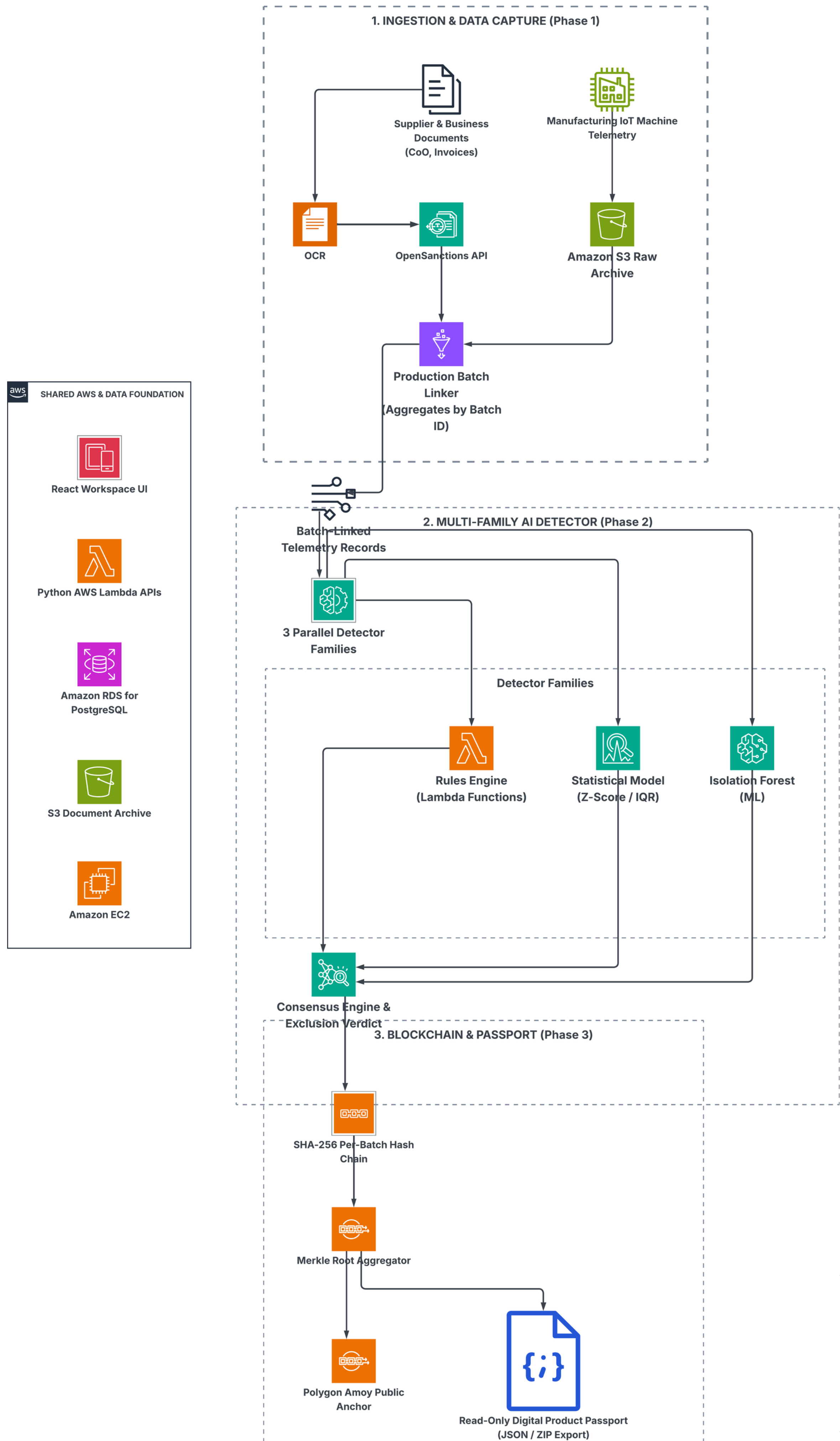
03 - OBSERVE

Capture manufacturing machine evidence - runtime, stitch counts, cycle speeds and production activity - in real time.

05 - PROTECT

Chain verified evidence with SHA-256 hashes and daily Merkle roots, anchored on Polygon, to make tampering detectable.

SYSTEM ARCHITECTURE



AI/ML ANAMOLY ALGORITHM

IMPOSSIBLE PRODUCTION
Rules-Based
Detects output registered with zero or near-zero runtime ($\leq 5s$).

ML MULTIVARIATE OUTLIER
Machine Learning
Isolation Forest models detect complex multi-feature anomalies.

DATA TAMPERING
Statistical + ML
Identifies artificially inflated cycle times far above baseline.

ERRATIC OPERATOR / PROCESS
Statistical
Captures high variance in cycle times caused by inconsistent handling.

MATERIAL FRAUD
Rules-Based + ML
Flags mass-balance violations (too many units produced for volume of material input)

UNDECLARED LABOR
Rules-Based
Flags off-hours production signals (potential UFLPA forced-labor risk).

BLOCKCHAIN IMPLEMENTATION

SHA-256 HASH CHAIN

Hashes raw IoT & operational events sequentially per batch to make local data tamper-evident

MERKLE ROOT GENERATION

Aggregates thousands of batch transactions into a single cryptographic hash for scalability

POLYGON ON-CHAIN STATE

Commits the Merkle Root to Polygon, creating a permanent, low-cost public audit trail

We use SHA-256 hash chaining and Merkle trees to compress thousands of factory IoT logs into a single daily proof on Polygon, giving buyers full tamper-evidence for UFLPA compliance without exposing trade secrets or paying high gas fees