

SUSTAINABLE DEVELOPMENT GOAL
PEACE, JUSTICE AND
STRONG INSTITUTIONS

 SOLUTION CHALLENGE

Reunify

AI-Powered Missing Persons Reunification

Reuniting families across borders with safe, human-guided AI.

GITHUB REPOSITORY

 github.com/xjning03/my_reunify_app

TEAM

X



Problem & SDG Alignment

The Global Challenge

Memory-Based Clues Are Ignored

Young or traumatized children often remember sensory fragments such as hearing a dialect, seeing the sea, recognizing a mall, rather than names or addresses. Current systems require structured identifiers, leaving these vital descriptive clues unused.

Manual & Reactive Processes

Existing solutions rely on manual reports, public alerts, and social media sharing without intelligent system to automatically analyze, match, and prioritize cases in real time, slowing down urgent responses.

Disconnected Search Channels

Police, welfare departments, shelters, hospitals, and NGOs operate on separate platforms. Without centralized data-sharing or cross-matching, children and families may search in parallel systems, missing the chance to reunite.



PRIMARY GOAL

SDG 16

Target 16.2

"End abuse, exploitation, trafficking and all forms of violence against and torture of children."

ALSO SUPPORTING

SDG 11 Sustainable Cities and Communities

Target 11.7 (Ensure universal access to safe, inclusive, and accessible public spaces, particularly for women, children, older persons, and persons with disabilities)

The Global Crisis in Numbers

Sources: PDRM | INTERPOL | ICMEC | UN Data



ANNUALLY

Millions

Children reported missing globally each year



CRITICAL TIME

48h

First 48 hours are vital for safe recovery



PROCESS

Manual

Most of the matching process is non-automated

Malaysia's Reunification Gap

Current manual processes create a massive drop-off from initial reports to verified matches.



13,969+

children under 18 were reported missing in Malaysia over the past decade.

Current Solution

- NUR Alert
- Police reports
- Social media sharing
- Baby hatch initiatives



**Manual & Reactive &
Disconnected across agencies**

User Feedback & Iteration

01 SOURCE: FAMILIES



Insight: Language Barriers

Complex forms and language gaps caused high drop-off rates during initial reporting by displaced families.



✓ Iteration: Guided Voice Intake

Implemented multimodal input and **Translation APIs** to allow reporting in multilanguages.

02 SOURCE: COMMUNITIES



Insight: Trust Deficit

Users were hesitant to upload photos of children due to fear of data misuse or government surveillance.



✓ Iteration: Privacy-First AI

Shifted to storing **vector embeddings** instead of raw images where possible and added clear, granular consent screens.

03 SOURCE: CASEWORKERS



Insight: Review Fatigue

NGO staff were overwhelmed by false positives in manual photo matching lists, slowing down urgent cases.



✓ Iteration: AI Confidence Scoring

Added **Gemini-powered reasoning** to rank matches by confidence and generate "Why this match?" explanations.

04 SOURCE: FIELD AGENTS



Insight: Connectivity Gaps

Internet access is often unstable in refugee camps or border zones, causing report failures.



✓ Iteration: Offline-First Mode

Architected Flutter app for local storage (SQLite) with **background sync** logic when connectivity is restored.

Success Metrics & Scalability

Projected outcomes based on pilot data



100+

VERIFIED MATCHES

Target for Year 1 Pilot



< 3d

TIME TO IDENTIFY

Reduced from weeks/months



95%

TOP-5 PRECISION

With human-in-the-loop verification



< RM0.50

COST PER SEARCH

Using optimized vector search

SCALABILITY ROADMAP

01

Phase 1: MVP Pilot

Months 1-3 • Single Region

- ✓ Deploy Flutter app to 2 partner NGOs
- ✓ Manual review workflow with < 10k records
- ✓ Test Gemini multimodal intake forms

02

Phase 2: Expansion

Months 4-12 • Multi-Region

- ✓ Vertex AI Matching Engine integration
- ✓ Cross-border data sharing protocols
- ✓ Support for 10+ languages & offline mode

03

Phase 3: National Network

Year 2+ • Global Scale

- ✓ Government & Law Enforcement integration
- ✓ Standardized Interoperability APIs
- ✓ Independent Ethics Board governance

AI Integration & Architecture



1. Multimodal Intake

CORE TECH

- Translation API
- Gemini Multimodal

Handles text input in 3 languages (English, Chinese, Bahasa Malaysia). Gemini assists filling reports from fragmented descriptions.



2. Safety & Vectorization

CORE TECH

- Cloud Vision API
- Firebase ML

Vision API filters harmful content. Text converted to vector embeddings.



3. Similarity Search

CORE TECH

- Vertex AI Vector Search
- Matching Engine

Matches vague scene-based memories (e.g., coastal reference, dialect cues, age range) to probable geographic regions and demographic profiles.



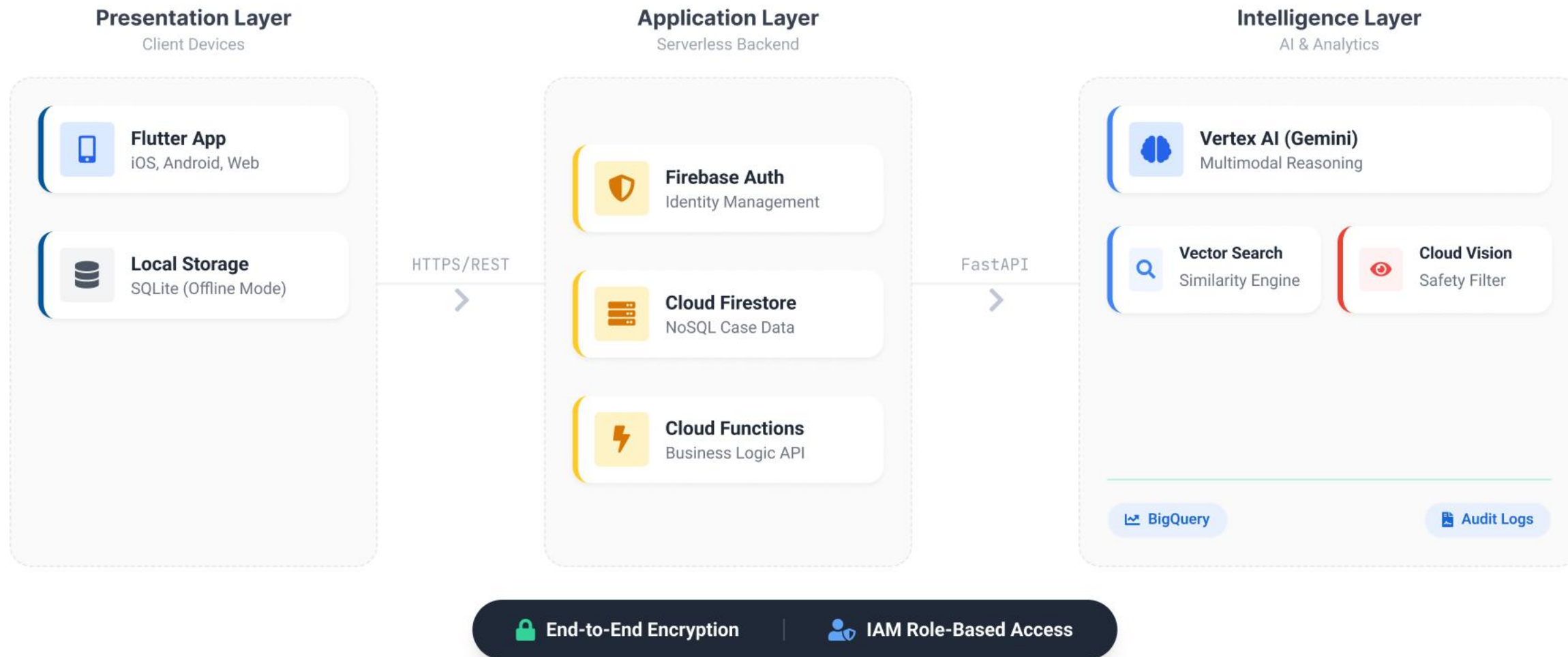
4. Explainable Review

CORE TECH

- Gemini 1.5 Pro
- Human-in-the-loop

Generates natural language explanations. Humans make final verification.

Technical Architecture



Implementation & Key Challenges



RELIABILITY

Challenge: Memory Subjectivity

Children's recollections are often sensory or emotional rather than geographically precise, limiting reliability.



Solution: Semantic Memory Processing

Use multilingual NLP and embedding models to interpret descriptive inputs and rank potential matches rather than relying on exact geographic identifiers.



ACCURACY

Challenge: Landmark Transience

Urban redevelopment may replace or significantly alter childhood landmarks over time, reducing the accuracy of memory-based geographic matching.



Solution: Temporal Landmark Mapping

Incorporate historical map layers and timestamped POI datasets to match memories against landmarks relevant to the child's estimated time period.



ALGORITHMIC

Challenge: AI Bias

Matching models may underperform across different demographic groups (e.g., age, ethnicity), leading to uneven ranking accuracy or unintended exclusion.



Solution: Fairness-Aware Model Optimization

Plan for continuous fine-tuning using diverse, regionally representative datasets. Incorporate rule-based constraints to reduce disproportionate scoring across groups.



AMBIGUITY

Challenge: Geospatial Noise

Broad descriptions such as "near the sea" or "by the hills" may correspond to large geographic areas, increasing ambiguity and false-positive matches.



Solution: Weighted Geo-Filtering

Apply multi-factor scoring by combining language cues, proximity signals, and contextual keywords to narrow search regions intelligently.

Functional Prototype

Share Your Memory

Help us identify who you are and what you remember. Every detail counts!

Case Status

Is this an active search or a case from years ago?

Case Type

Past Case - Missing for Years

Your Memory

What do you remember?

Language

English

Child Details

Child's Name

1. Multimodal Intake

Multilanguage Text + Image

My Memory & Matches

My Memory

31m ago

I remember a big mall near the sea. There was a playground and many people speaking Malay.

Certainty

Clear

Language

EN

GPS recorded

How I felt

happy

excited

Potential Matches (4)

#1 Ahmad Bin Razak

Sunshine Mall, Beach Area

90%

Match Confidence

90%

Why this match?

- Strong semantic similarity between memory and case (96.0%)
- Case reported recently (99.8% time relevance)
- Geographic proximity detected (95.3% match)

Score breakdown

Semantic Relevance: +1

Time Recency: +1

Location Proximity: +1

Memory Confidence: +1

View Case

Chat

2. AI Matching

Confidence Scores + Explanations

Chat with Contact

Secure & private

Hi, I heard there might be a match. Can we talk?

7:35

Yes, I remember the temple and the festival music.

7:37

Type a message...



3. Chat & Verify

Human-in-the-loop validation

Impact & Future Vision

Near-Term Impact

- ✓ Accelerate Case Prioritization by **50%**
- ✓ Ensure structured case submissions
- ✓ Empower families with instant feedback

Partnerships

- NGOs** Local Enforcement & Welfare Agencies
- Tech** Telecom Partnerships for Zero-Rated Access
- Legal** Community-driven reunification assistance

Sustainability

- 🔗 Open-Source Core Platform (MIT Licensed)
- ☁️ Cloud Infrastructure Credits & Nonprofit Grants
- 👥 Community-driven Dataset Governance

Strategic Roadmap



Phase 1: Pilot (Current)

MVP VALIDATION

Single region deployment.
Focus on **Family Consent** flows.
Manual review of all AI matches.



Phase 2: Expansion (1 Year)

GROWTH & ACCESS

Partner with **3 Major NGOs**.
Expand to **other regions**.
Launch Offline-Ready Mobile Response Kits.



Phase 3: Ecosystem (3 Years)

INTEROPERABILITY

Global Data Standard Adoption.
Third-Party Ethical Review & Accountability.
Cross-border Government Integration.

Thank You!

Together, we can use technology to reunite families and bring hope to the missing.



Explore the Code

Check out the Flutter implementation and contribute to the open-source project.

github.com/xjning03/my_reunif...



Get in Touch

Questions about the architecture or implementation details? Reach out.

jncheah.03@gmail.com

Project Lead