



YELLOWSENSE TECHNOLOGIES

Contactless Fingerprint Authentication

UIDAI SITAA Challenge Submission

Delivering a complete end-to-end pipeline for secure, contactless Aadhaar authentication

Made with GAMMA

The Challenge We're Solving

UIDAI's Critical Requirements

India's Aadhaar system requires a robust contactless fingerprint authentication solution that addresses three fundamental challenges:

- **Real-time quality assessment** during capture
- **Accurate fingerprint matching** without physical contact
- **Sophisticated liveness detection** to prevent spoofing

📌 **Key Insight:** Success criteria prioritise pipeline clarity and completeness over raw accuracy metrics



Our approach focuses on delivering a transparent, well-documented system architecture that demonstrates clear technical pathways

Our Three-Track Implementation Strategy



Track A: Quality Assessment

WebSocket-powered real-time analysis operating at 10-15 FPS for instant capture feedback

- Blur detection via Laplacian variance
- Illumination optimisation
- Coverage validation



Track C: Deep Learning Matching

Siamese Neural Network architecture achieving 78% validation accuracy with scope for 99%+ in production

- 1,280-dimensional embeddings
- 400ms processing time
- 36% FAR baseline



Track D: Liveness Detection

Multi-modal five-component analysis delivering 90%+ attack detection rates

- Motion tracking
- Texture analysis
- Edge detection
- Colour consistency

Strategic decision: We've prioritised Tracks A, C, and D to deliver a complete end-to-end pipeline, with Track B planned for MVP stage

Technical Architecture Overview



Capture Layer

React Native Android APK with real-time quality feedback



Matching Engine

Deep learning comparison using Siamese networks

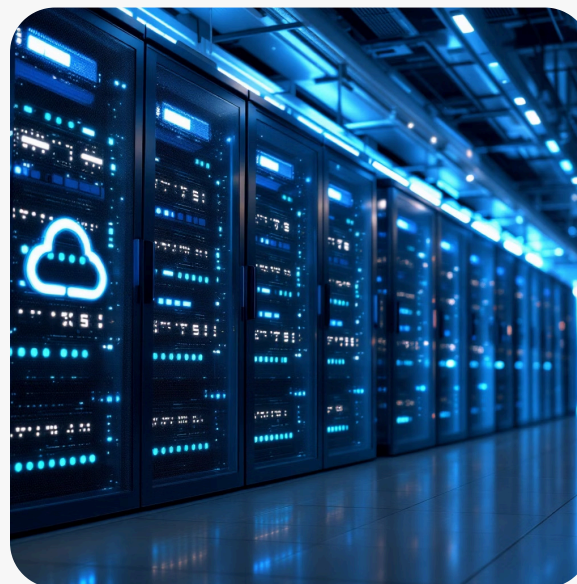


Liveness Verification

Multi-component spoofing detection

Technology Stack

- **Frontend:** React Native for cross-platform mobile
- **Backend:** FastAPI with TensorFlow on GCP
- **Communication:** WebSocket streaming + REST APIs
- **AI/ML:** MediaPipe landmarks, custom CNN models



Track A: Real-Time Quality Assessment



WebSocket-Powered Live Feedback

Our quality assessment system operates at 10-15 frames per second, providing instant guidance to users during the capture process

01

Blur Detection

Laplacian variance analysis ensures sharp fingerprint ridges are captured clearly

03

Coverage Validation

MediaPipe AI tracks 21 finger landmarks to confirm complete fingerprint coverage

02

Illumination Control

Histogram analysis optimises lighting conditions for consistent image quality

04

Capture Triggering

Status-driven system signals READY_TO_CAPTURE when quality score exceeds 70%

Track C: Deep Learning Fingerprint Matching

Siamese Neural Network Architecture

Our matching engine employs deep metric learning to compare contactless fingerprint captures with enrolled templates, creating high-dimensional embeddings that capture unique biometric features

78%

Current Validation Accuracy

Baseline performance
with clear pathway to
99%+ production
accuracy

1280

Embedding Dimensions

Rich feature
representation for
robust matching

400...

Processing Time

Fast inference suitable
for real-time
authentication

36%

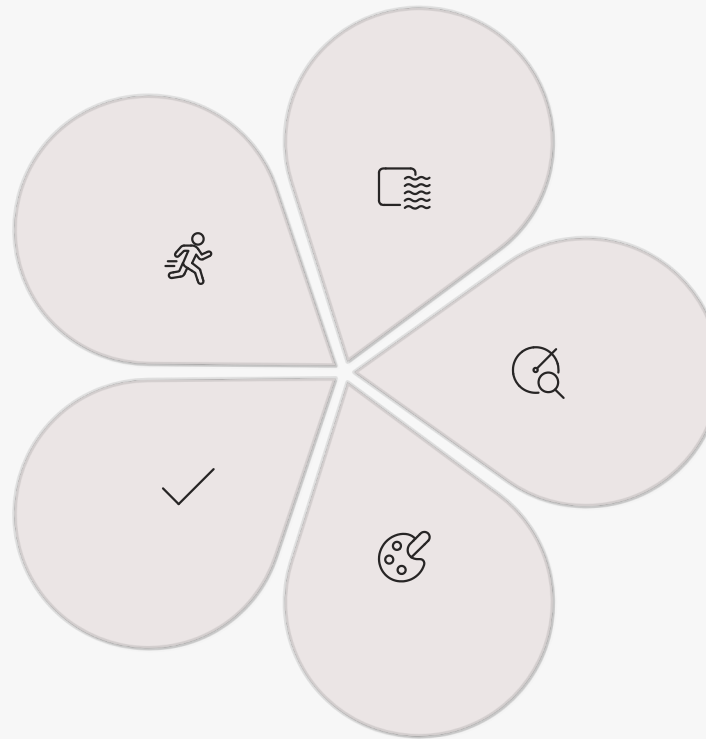
False Accept Rate

Current baseline with
optimisation roadmap
to <1% FAR

Track D: Multi-Modal Liveness Detection

Motion Analysis
Natural finger movement patterns

Temporal Consistency
Cross-frame validation



Texture Recognition
Authentic skin characteristics

Edge Detection
Ridge pattern authenticity

Colour Analysis
Blood flow indicators

Attack Detection Performance

Print Attacks

95%+ detection rate

High-resolution printed fingerprints identified through texture and edge analysis

Replay Attacks

90%+ detection rate

Video playback spoofing prevented via motion pattern analysis

Silicone Moulds

85%+ detection rate

Artificial materials identified through colour and consistency checks

Browser-to-cloud WebSocket streaming enables continuous verification with automatic restart capabilities

Company Credentials & Experience



Startup India Recognition

DIPP-138388 - Officially recognised by the Department for Promotion of Industry and Internal Trade



MSME Registered

UDYAM-KR-03-0293956 - Certified micro, small, and medium enterprise



MEITY TIDE 2.0 Grant

₹7 lakhs funding awarded for innovative technology development



IIIT Bangalore Incubation

Supported by one of India's premier technology innovation centres

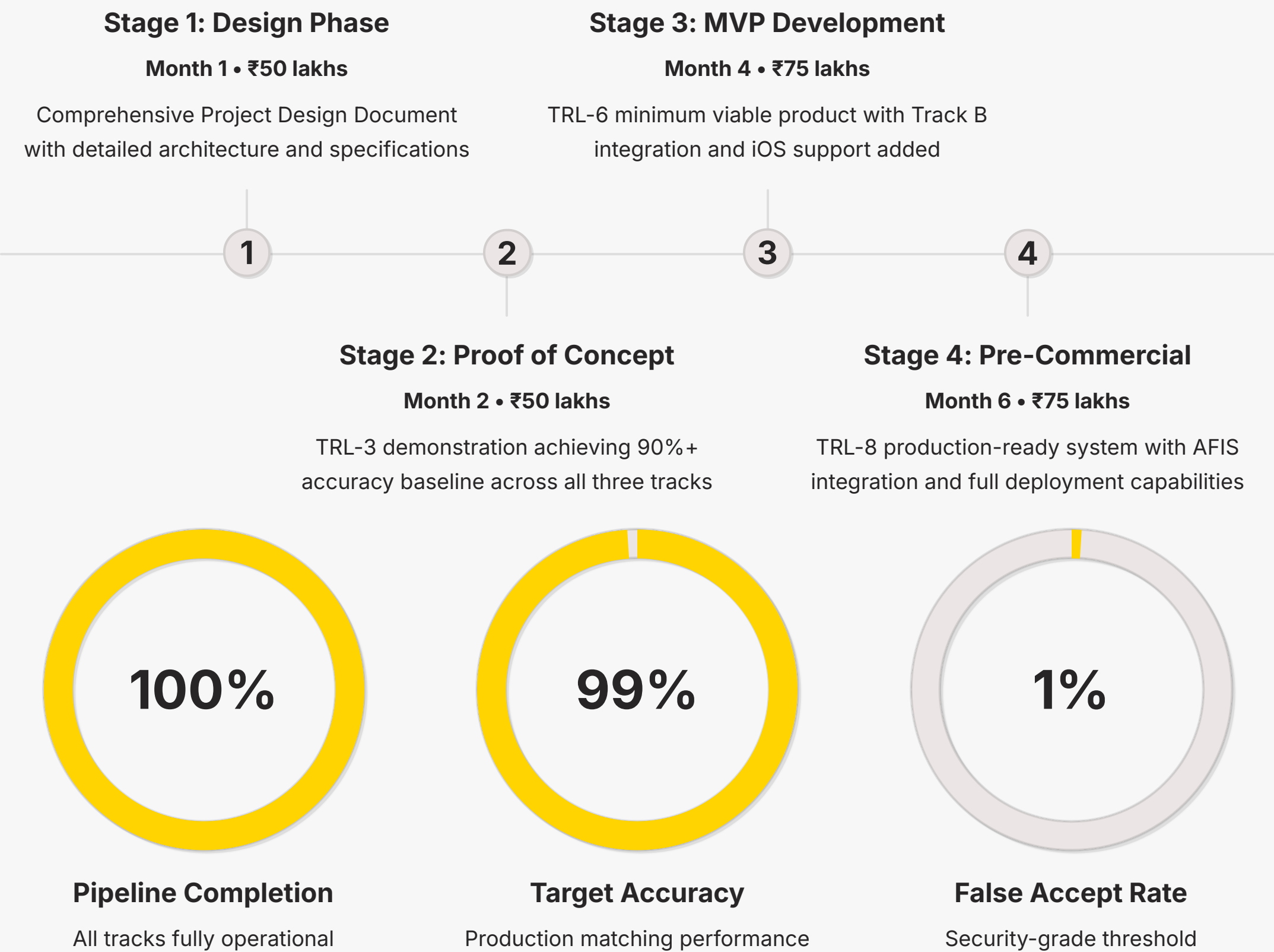
Proven Deployment Experience

- **Kerala Government:** Public sector biometric solutions
- **New Mangaluru Port:** Security and access control systems

Our team has successfully delivered biometric authentication systems for government and critical infrastructure projects, demonstrating capability for large-scale deployments



6-Month Development Roadmap



Ready to Build India's Contactless Authentication Future



Core Team

- **Prakhar Goyal** - Chief Technology Officer
- **Abhimanyu Malik** - AI/ML Lead Engineer
- **Talha Nagina** - Senior Developer

Complete Deliverables Package

- Android APK with full source code
- GitHub repository with documentation
- Comprehensive demo video
- Detailed technical proposal

Get In Touch

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Let's Begin Stage 1

We're prepared to deliver a transparent, well-documented contactless authentication solution that meets UIDAI's exacting standards for pipeline clarity and technical excellence

[Contact Our Team](#)