

RAKTHSEVA: Revolutionizing Thalassemia Care with AI

-ByARYANWANJARI
aaryanwanjari77@gmail.com

1 Problem Statement

[Go to last page for summary](#)

Thalassemia patients in India face:

- **Donor Scarcity:** Difficulty finding compatible donors in time, especially in rural areas.
- **Data Fragmentation:** Lack of centralized, real-time donor and patient data.
- **Logistical Delays:** Slow blood delivery due to poor coordination.
- **Language Barriers:** Indias linguistic diversity complicates education and support.
- **Fraud and Misinformation:** Inconsistent records compromise trust.
- **Awareness Gap:** Limited public knowledge reduces donation participation.

2 Proposed Solution

RAKTHSEVA is an AI-driven, mobile-first platform that:

- Connects patients with donors in real-time via AI matching.
- Integrates with RAKTHSEVA API, Indian Red Cross, Rotary Blood Bank, and e-RaktKosh.
- Optimizes logistics with quick commerce (Swiggy, Blinkit, Zepto, Delhivery).
- Provides multilingual AI support with SARVAM AI-inspired voice models.
- Ensures data security with hash-chained logging and encryption.
- Motivates donors with gamification and nationwide Blood Warrior campaigns.
- Onboards labs, hospitals, and NGOs for seamless connectivity.

4 AIModelsandComponents

4.1 PredictiveDonorAvailability

Description: Uses LSTM with attention and Prophet ensemble for hierarchical forecasting by blood group/region. Continuous retraining leverages distribution feedback. Outputs heatmaps and notifications via the app.

3. Technology stack

Layer	Technology
Frontend	React Native, Tailwind CSS
Backend	Node.js, Express.js
Database	MongoDB, PostgreSQL (hash-chained ledger)
AI/ML	TensorFlow, PyTorch, XLM-R, SARVAM AI TTS
APIs	RAKTHSEVA, Indian Red Cross, Google Maps, DigiLocker
Security	AES-256, TLS 1.3, SHA-256 Hash-Chaining
Hosting	AWS (EC2, S3, Lambda, RDS), Kubernetes
DevOps	Docker, GitHub Actions, Kafka

Table 1: RAKTHSEVA Technology Stack

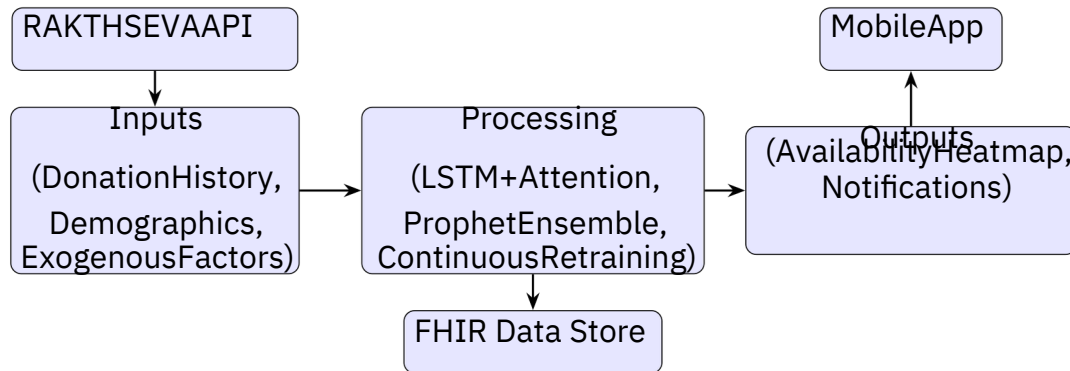


Figure 1: Predictive Donor Availability

4.2 Blood Distribution Optimization

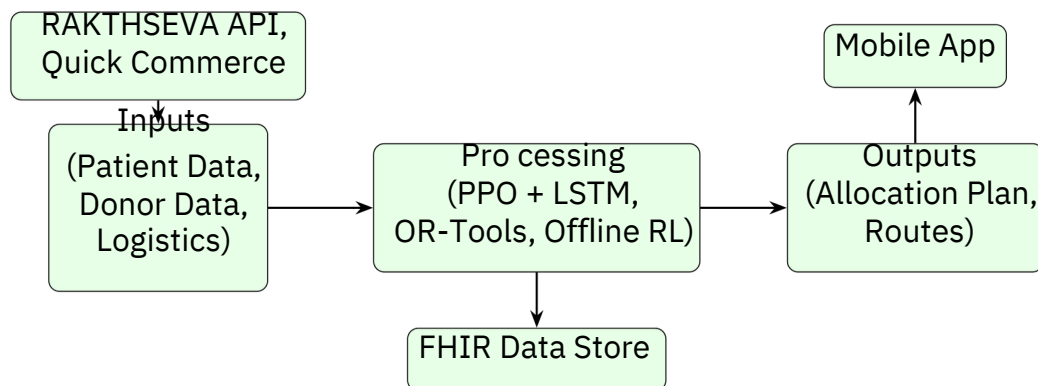


Figure 2: Blood Distribution Optimization

Description: PPO with LSTM and OR-Tools optimizes blood allocation using multi-agent RL. Offline RL ensures robustness. Outputs plans and routes, integrated with quick commerce APIs.

4.3 Multilingual AI Assistant

Description: XLM-R with SARVAM AI-inspired TTS handles 12+ languages. Human over-rides ensure accuracy. Local processing enhances privacy. Outputs responses and videos via the app.

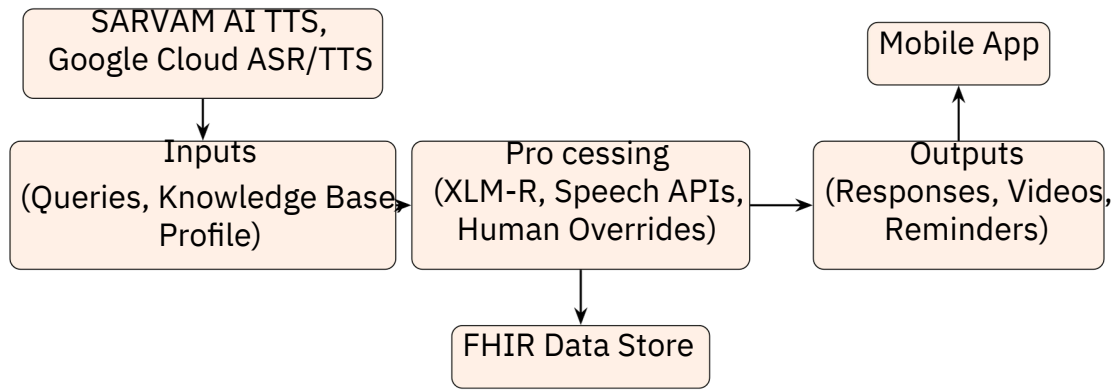


Figure 3: Multilingual AI Assistant

4.4 Contradiction Detection & Fraud Prevention

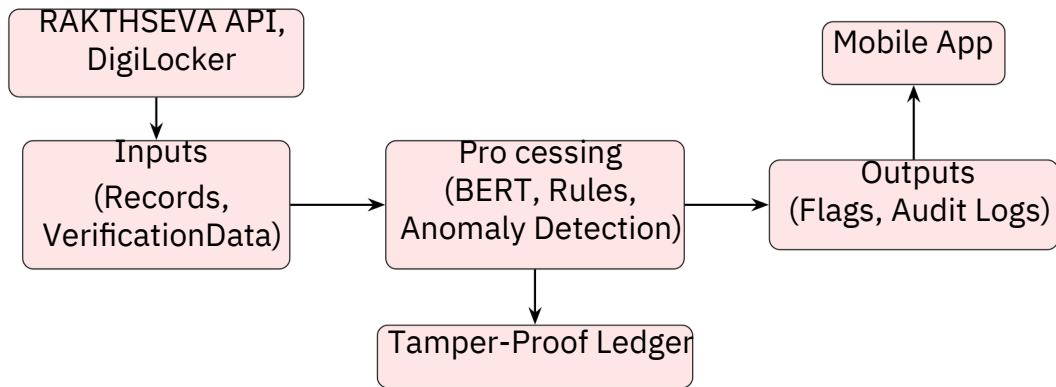


Figure 4: Contradiction Detection & Fraud Prevention

Description: BERT with rule-based checks and anomaly detection identifies fraud. Knowledge graph enhances transparency. Outputs flags and logs to the tamper-proof ledger.

4.5 SLM-Based Data Analysis & Leak Detection

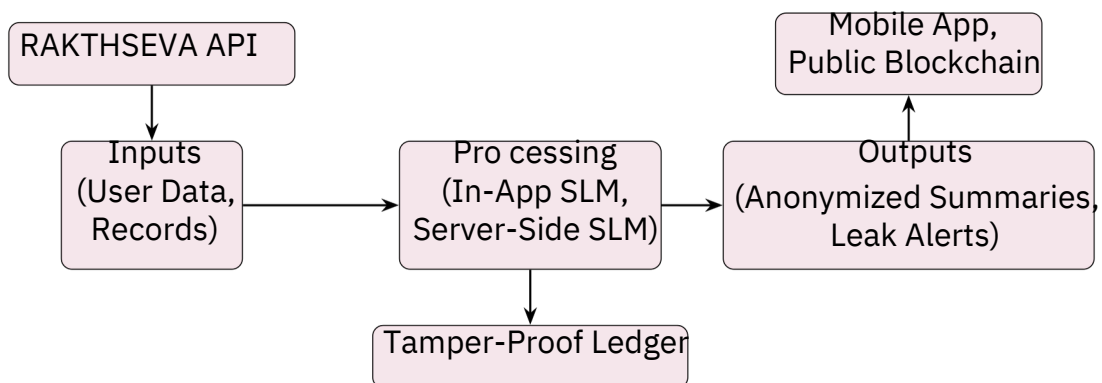


Figure 5: SLM-Based Data Analysis & Leak Detection

Description: In-app SLM anonymizes user data; server-side SLM detects leaks. Anonymized summaries are published to a public blockchain for research, integrated with the app and ledger.

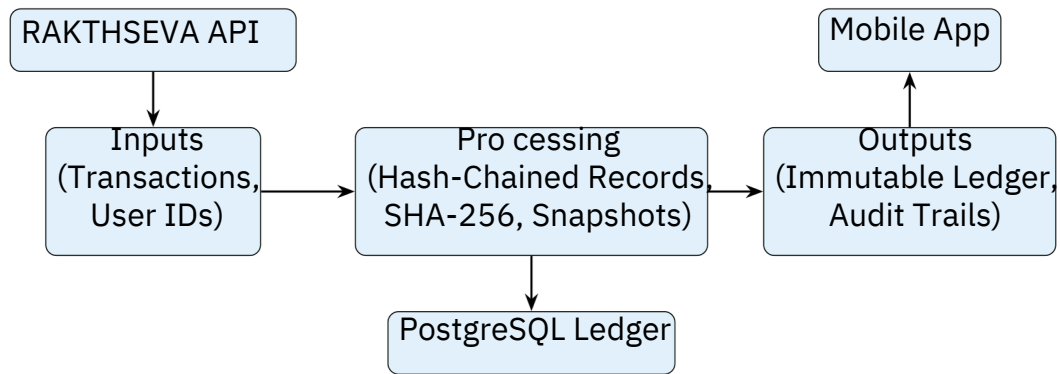


Figure 6: Tamper-Proof Data Logging

4.6 Tamper-ProofDataLogging

Description: Hash-chained records in PostgreSQL with SHA-256 ensure tamper-proof logging. Public snapshots enhance transparency. Outputs are accessible via the app.

4.7 Gamification&MotivationSystem

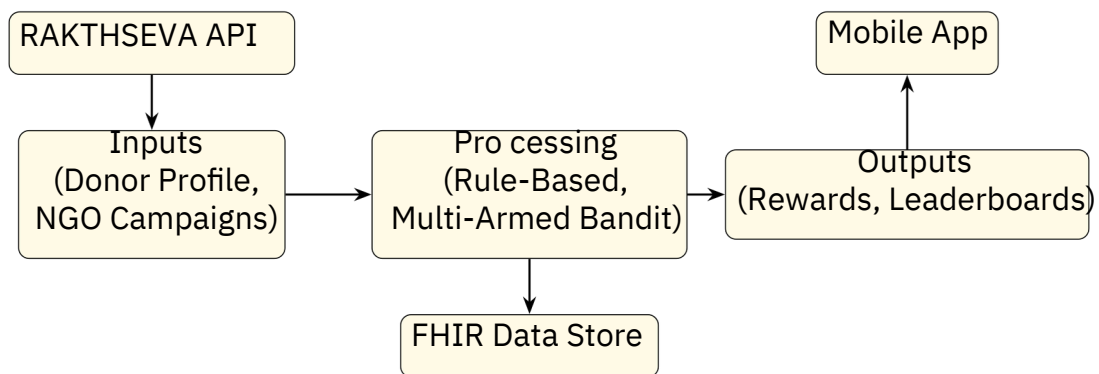


Figure 7: Gamification & Motivation System

Description: Rule-based system with multi-armed bandit optimizes donor rewards. Outputs badges and leaderboards, integrated with the app and FHIR store.

4.8 Inter-ModelCoordination

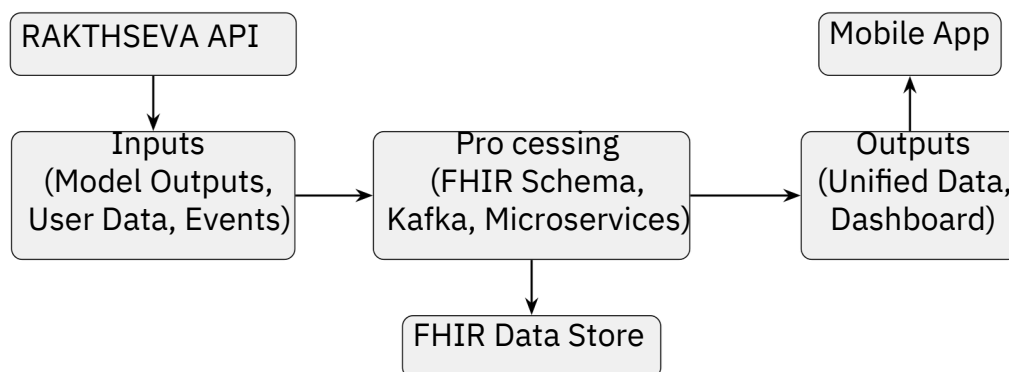


Figure 8: Inter-Model Coordination

Description: FHIR schema and Kafka unify model interactions. Microservices enable modular API access, outputting consistent data and KPIs.

5 AdditionalFeatures

- **Blood Bank Integration:** Connects with Indian Red Cross, Rotary Blood Bank, e-RaktKosh for comprehensive data.
- **Healthcare Provider Onboarding:** Labs, hospitals, NGOs integrated via RAKTH-SEVA app for one-click patient access.
- **Nationwide Blood Warrior Network:** Coordinates Blood Warriors PAN-India for community engagement.

6 Implementation Plan

- **Phase 1 (3 months):** Prototype with matching and SLM-based analysis.
- **Phase 2 (6 months):** Deploy AI models, voice assistant, and quick commerce integration.
- **Phase 3 (3 months):** Scale with hash-chained logging and nationwide rollout.

7 Impact

- **Wait Times:** Reduced from 48+ to <24 hours.
- **Donations:** 25%+ increase via gamification.
- **Access:** 50%+ rural coverage in 2 years.
- **Integrity:** <0.5% fraud rate.

8 Conclusion

RAKTHSEVA transforms Thalassemia care with advanced AI, secure logging, and inclusive design, creating a scalable, impactful ecosystem for patients, donors, and Blood Warriors.

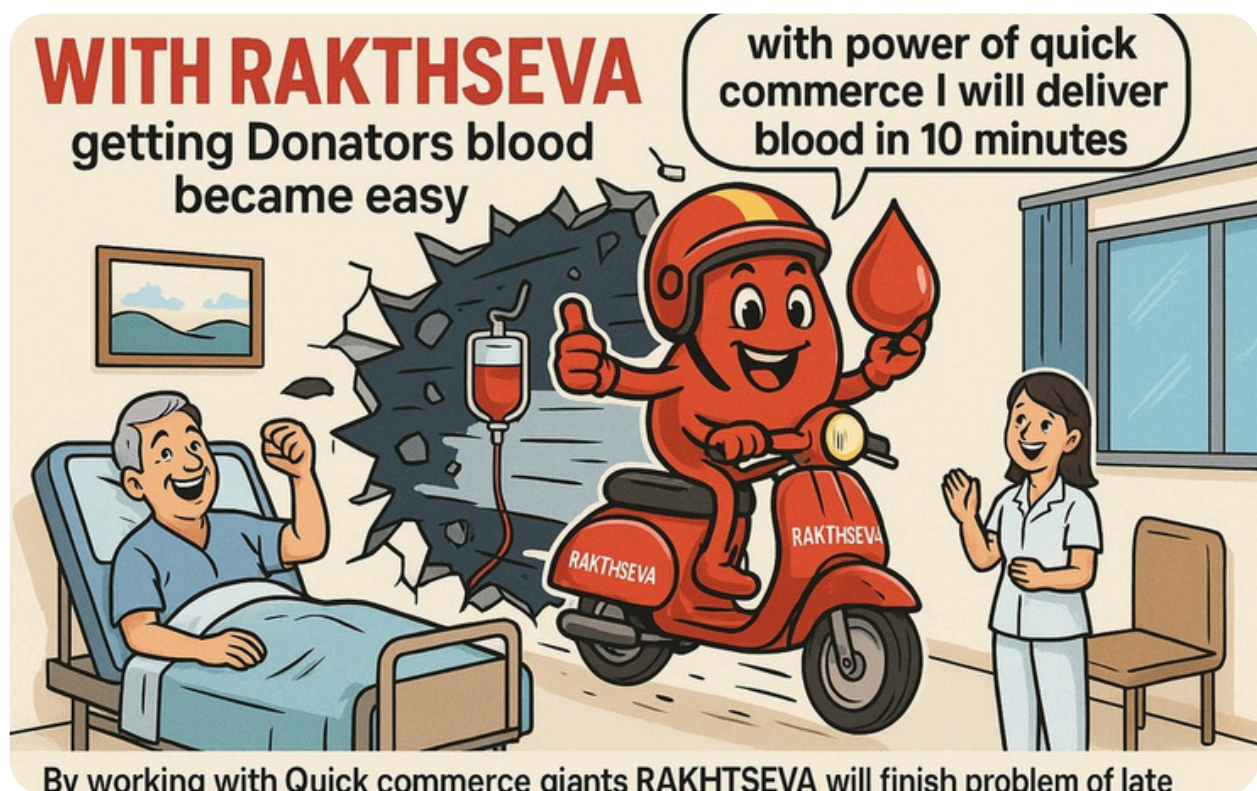
9. **Compliance needed:** • **HIPAPAA (Health Insurance Portability and Accountability Act).** • **India's Personal Data Protection Bill (PDPB).** • **ISO 27001 for information security management.**

10. summary

RAKTHSEVA is an AI-powered mobile app revolutionizing Thalassemia care in India. It tackles donor scarcity, data fragmentation, and logistical delays by:

- Matching patients with donors in real-time using LSTM+Prophet AI.
- Optimizing blood delivery with PPO+OR-Tools and quick commerce (Blinkit, Zepto).
- Offering a multilingual AI assistant (XLM-R, SARVAM AI TTS) for 12+ languages.
- **Detecting fraud with BERT and rule-based checks.**
- **Securing data via hash-chained PostgreSQL ledger.**
- **Motivating donors with gamified rewards and Blood Warrior campaigns.**
Your paragraph text
- **Integrating e-RaktKosh, Indian Red Cross, labs, and hospitals via FHIR. It reduces wait times to <24 hours, boosts donations by 25%, and ensures secure, inclusive healthcare access nationwide**

“My personal opinion says RAKTHSEVA can really do an big Change in ecosystem please make it possible I think a lot many Patients are in need of Fast, efficient and safe healthcare facilities, If I ever got an chance I would surely made it possible but BLOOD warrior has the power which can make it in reality”.



Easiest explanation of all models can be explained to a child

1. Predictive Donor Availability: LSTM + Attention + Prophet Ensemble

LSTM + Attention + Prophet Ensemble

TEasy Version:

Imagine you have a magical calendar 📅 that remembers when your friends give you toys. It notices patterns — like "Oh! Raju gives me toys every Sunday!"

Now, another friend — the Attention fairy 🧚 — whispers, "Look! Some days are more special than others."

And then the Prophet wizard 🧙 looks at holidays and weather and says, "This Sunday might be rainy, maybe Raju stays home!"

Together, they guess who will give you a toy next, and when! That's how we know which blood donors are most likely to help soon!

2. Blood Distribution Optimization: PPO + OR-Tools

easy Version:

You want to deliver chocolate 🍫 to your friends who are far away. But which path is fastest?

The OR-Tools robot 🤖 is like a smart GPS—it finds the best route to each friend.

And PPO (Pro Player Optimizer) is like a learning superhero 🦸 who practices over and over to get better at giving out chocolate the fastest!

Together, they make sure the chocolate reaches friends before it melts — or in our case, blood reaches patients quickly.

3. Multilingual AI Assistant: XLM-R + SARVAM AI TTS

easy Version:

Your smart teddy bear 🧸 can talk to you in your language—Hindi, Marathi, Tamil, anything! That's because inside the teddy is a brain called XLM-R 🧠 that understands many languages.

Then, SARVAM AI gives the teddy a cute voice 🗣️, so it talks to you like your friend, in your favorite voice and words!

So anyone, from anywhere, can talk and understand it easily.

4. Contradiction Detection & Fraud Prevention: BERT + Rule-Based Anomaly Detection

easy Version:

You told your teacher you ate your vegetables, but your lunchbox is still full... uh-oh!

BERT is like a clever teacher 🧑🏫 who reads what you say and finds when things don't match.

And the rule-checking robot 🤖 has a list: "If you say YES but the box says NO = ⚠ Warning!"

Together, they stop fibs and mistakes to keep things fair and safe—just like checking if someone is lying about donating blood.

5. SLM-Based Data Analysis & Leak Detection: Small Language Model (SLM)

Toddler Version:

SLM is like a tiny detective mouse 🐭 inside your toy box.

It sneaks around and checks if anything is leaking or missing.

It reads notes and patterns and says, “Hmm, this toy is always gone on Thursdays... suspicious!”

So, it finds little secrets in big rooms—and makes sure nothing important gets stolen or shared by mistake!

6. Gamification & Motivation System: Multi-Armed Bandit

Toddler Version:

You’re playing a game with many surprise boxes 📦. Some give candy 🍬, some give stickers ★.

You don’t know which box is best, so you try a little from each.

After a while, you figure out “Oh! Box 3 gives candy most often!”

The Multi-Armed Bandit is like a smart player who learns quickly which rewards make people happiest — and gives those more!

That’s how we motivate Blood Warriors to keep playing (donating) again and again.