- ## TECH STACK:

Our solution leverages a hybrid architecture, combining the immutable trust of the Polygon blockchain with the speed of Firebase and the on-device intelligence of Google ML Kit.

Frontend & Mobile Experience

- **Framework: Flutter (Dart)**
  - *Usage:* **Develops a single, high-performance codebase for both iOS and Android. It powers two distinct user flows: the Manufacturer Dashboard (for minting) and the Consumer Scanner (for verification).**
- **UI/UX Libraries:**
  - **Leaflet.js: Integrates into the Admin view to render a "Counterfeit Heatmap," visualizing locations where fake medicines are scanned.**

Blockchain & Web3 Layer

- **Network: Polygon Amoy Testnet**
  - *Usage:* **Chosen for its high throughput and low gas fees, making the "Burn on Scan" logic economically viable for mass-market adoption.**
- **Smart Contracts: Solidity**
  - *Usage:* **Implements the core logic for registerMedicine (minting new batches) and verifyMedicine (checking status). It enforces the "Burn on Scan" mechanism to prevent reuse of authentic QR codes.**
- **Development Environment: Hardhat**
  - *Usage:* **Used for compiling, testing, and deploying smart contracts to the Polygon network. It ensures robust security checks before deployment.**
- **Blockchain Interaction: Ethers.js**
  - *Usage:* **Acts as the bridge between the Flutter frontend and the blockchain, allowing the app to read contract states (Verify) and write transactions (Mint).**
- **Wallet Provider: MetaMask**

- ○ *Usage:* Serves as the authentication layer for manufacturers, requiring them to sign transactions physically to prove origin.

Backend & Decentralized Storage

- ● Cloud Backend: **Firebase (Google)**
  - ○ *Usage:* Handles non-critical data such as user authentication, manufacturer profiles, and "Report" logs. Cloud Functions trigger alerts when a "Fake" scan is detected.
- ● **Decentralized Storage: IPFS (InterPlanetary File System)**
  - ○ *Usage:* Stores heavy metadata (medicine photos, chemical composition docs) off-chain. This ensures that while the *hash* is on the blockchain, the *data* remains decentralized and tamper-proof without clogging the network.

AI & Specialized Tools

- ● Computer Vision: **Google ML Kit**
  - ○ *Usage:* Provides on-device, offline-capable QR code scanning. It ensures the app can instantly extract Batch IDs even in low-light conditions or if the physical label is slightly damaged.
- ● Leaflet.js Heatmaps:
- ● *Usage:Used for real-time geospatial visualization of counterfeit drug hotspots and global supply chain anomalies.*