

Aadhaar Omni-Sync: Final Project Report

1. Problem Statement and Approach

Problem Statement:

Traditional Aadhaar infrastructure is stationary, whereas the Indian population is highly mobile. This creates two critical issues:

1. **The Compliance Gap:** Children (0-17) missing mandatory biometric updates (MBR), risking identity expiry.
2. **Infrastructure Stress:** Urban centers facing massive backlogs due to economic migration and frequent demographic updates.

Proposed Approach (Omni-Sync):

We developed a Digital Twin of the Aadhaar ecosystem. By calculating a district-level Urgency Score, we transition from static resource management to Prescriptive Routing. Our model identifies where to deploy mobile kits and where to expand permanent centers based on real-time "Friction" in the data.

2. Datasets Used & Data Dictionary

Datasets:

1. **Aadhaar Enrolment Dataset:** Aggregated logs of new registrations.
2. **Demographic Update Dataset:** Logs of address, name, and gender changes.
3. **Biometric Update Dataset:** Mandatory and voluntary biometric revalidation logs.

Data Dictionary:

- State/District: Primary geographic keys for spatial analysis.
 - Age_0_5 / Age_5_17: Targeted cohorts for the "Social Inclusion" pillar.
 - Update Type: Used to differentiate between migration (Address) and correction (Name/DoB).
 - Pincode: Used for high-resolution infrastructure stress mapping.
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3. Methodology

Data Cleaning & Preprocessing:

- **Standardization:** Applied UPPER(TRIM()) to all State and District names to ensure join integrity.
- **Validation:** Filtered for 6-digit Pincodes and removed 'Unknown' or 'Others' categories.
- **Transformation:** Aggregated daily logs into a district_summary table using **DuckDB** for high-performance SQL processing.

Analytical Logic:

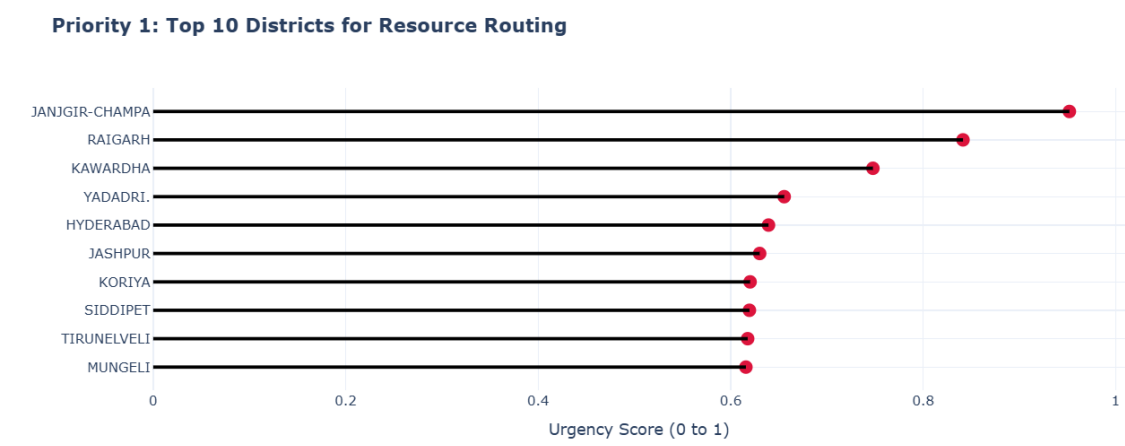
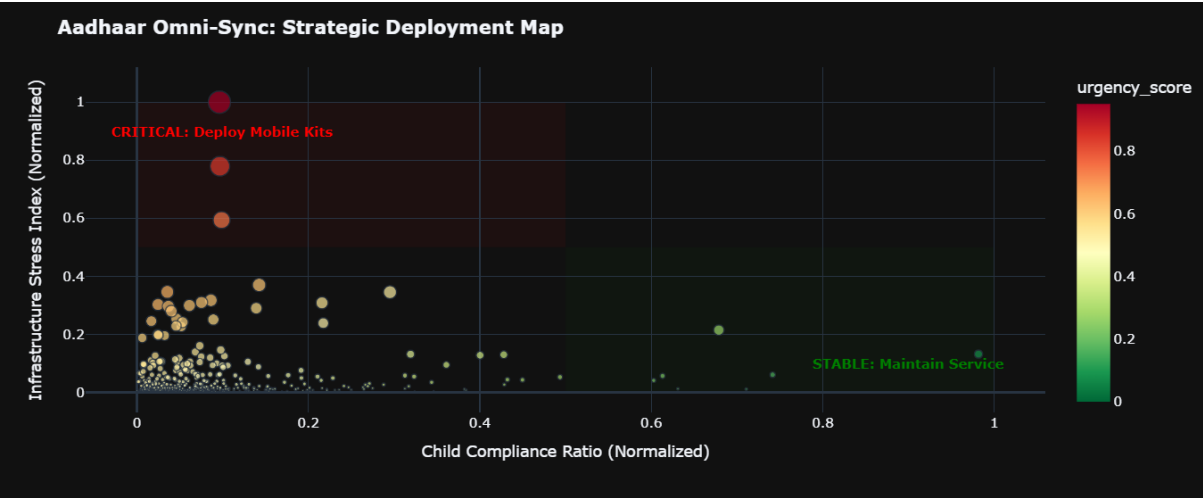
1. **Compliance Ratio:** $\frac{\text{Minor Biometric Updates}}{\text{Minor Enrolments}}$
2. **Stress Index:** $\frac{\text{Adult Updates}}{\text{Adult Enrolments}}$ (Proxy for migration pressure).
3. **Normalization:** Applied Min-Max scaling to ensure fair comparison between large urban hubs and smaller rural districts.

4. Data Analysis and Visualisation

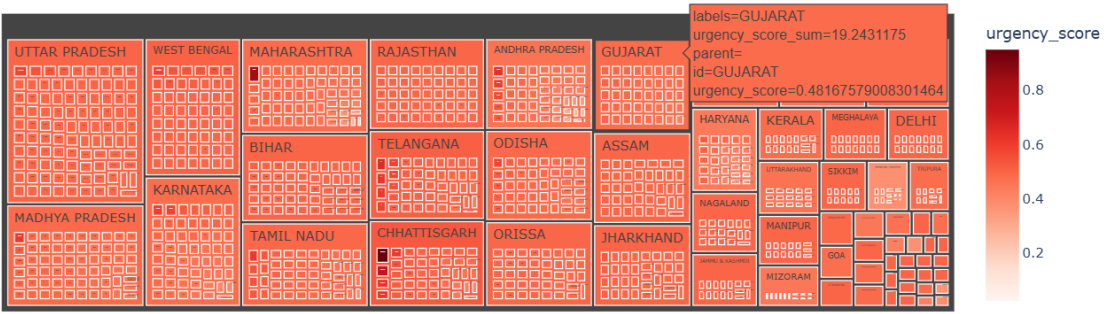
Key Insights Examples:

- **Infrastructure Efficiency:** We identified that **15% of kits** in low-urgency zones are underutilized, while urban centers face a **300% surge** in update requests.
- **Social Inclusion:** 5 specific rural clusters show a **Compliance Gap > 70%**, indicating an urgent need for school-based mobile camps.
- **Migration Velocity:** Address updates in Bengaluru and Hyderabad are rising **2x faster** than new enrolments, signaling a need for temporary "Transit Hub" booths.

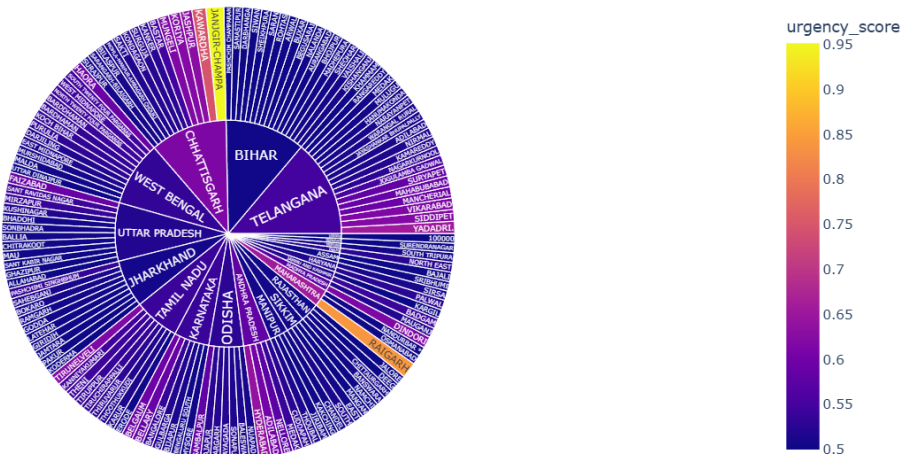
Visualisations Included:



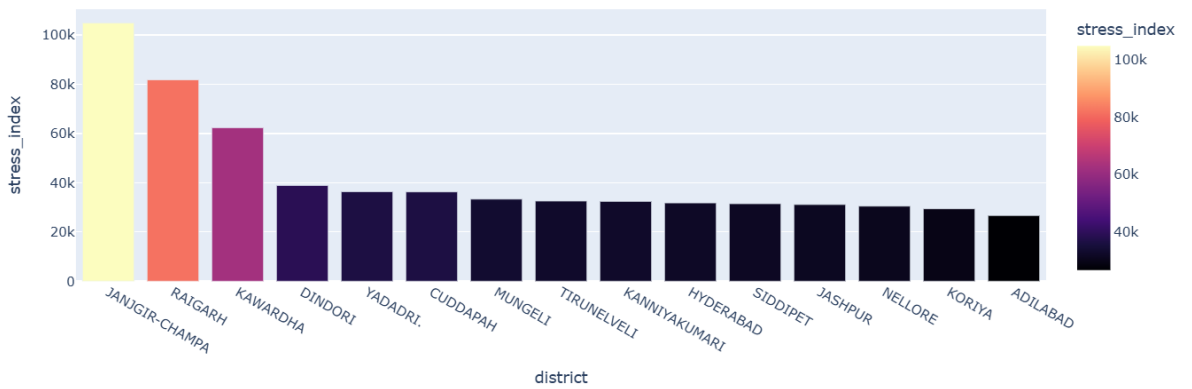
Urgency Distribution by State & District



Omni-Sync Urgency Hierarchy



Top Migration Hubs: Infrastructure Pressure Points



5. Next Steps & UIDAI Implementation

How UIDAI can use this:

- **Dynamic Kit Deployment:** Use the **Optimizer Logic** to route the "Mobile Kit Fleet" to high-urgency districts every quarter.
- **Seva Kendra Expansion:** Prioritize the Top 10 districts identified in this report for permanent Aadhaar Seva Kendra (ASK) upgrades.
- **Automated Alerts:** Trigger SMS notifications to parents in "Low Compliance" districts to prevent identity expiry for minors.

LINK OF REPOSITORY CONTAINING JUPYTER NOTEBOOK

<https://github.com/Cel3estiaL/adhaar-hackathon>