

Below is a **one-page technical design document**, written in a **professional, concise, and implementation-ready style**, aligned strictly to the solution you've defined and the specified tech stack.

Technical Design Document

Angel – Bridging the gap between medical services and patients across regions

Virtue Foundation – Hackathon MVP

1. Purpose & Scope

This system delivers an **AI-driven healthcare intelligence layer** that extracts structured medical capabilities from unstructured facility data, detects infrastructure gaps and suspicious claims, and maps regions at risk due to lack of access to critical medical expertise. The solution is optimized for **NGO planners and operational teams**, enabling faster, evidence-based decision-making in underserved regions.

Scope includes:

- Unstructured medical data extraction
 - Capability validation and gap analysis
 - Regional risk assessment (“medical deserts”)
 - Planner-friendly web and voice interfaces
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2. High-Level Architecture

Data → AI Extraction → Reasoning → Insights → Web / Voice Interfaces

1. Raw facility data (CSV / Excel)
 2. LLM-driven data cleaning & normalization
 3. Schema-constrained capability extraction
 4. Reasoning and gap detection
 5. Visualization, conversational access, and decision support
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3. Data Processing & Cleaning

Technologies

- **LLMs:** Lovable AI, OpenAI, ElevenLabs-integrated RAG
- **Databricks:** orchestration, validation, review

Process

- Ingest raw facility data into Databricks tables
 - Use LLMs to:
 - Normalize inconsistent text
 - Resolve duplicates and naming variants
 - Clean free-form capability, procedure, and equipment fields
 - Apply Virtue Foundation schema constraints to prevent hallucinations
 - Output schema-aligned, structured records with confidence annotations
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4. Intelligent Analysis & Reasoning Layer

Technologies

- **LLMs:** Lovable AI, OpenAI, ElevenLabs-integrated RAG
- **Databricks:** reasoning validation and debugging

Capabilities

- Extract medical procedures, equipment, specialties, and care levels
- Detect:
 - Missing prerequisite infrastructure
 - Facility type vs capability mismatches
 - Non-verifiable or overclaimed services
- Aggregate capabilities at city/region level
- Classify regions into risk tiers based on absence of critical care (e.g., emergency, maternal)

All reasoning is **schema-grounded and auditable**.

5. Web Platform & Dashboard

Website (Public & Planner Access)

- **Platform:** Lovable AI
- Hosts:
 - Facility search
 - Region-level medical desert insights
 - AI avatar and conversational access
- Designed for non-technical NGO users

Dashboard (Embedded)

- **Technology:** Claude
 - Features:
 - Interactive tables and summaries
 - Capability gap indicators
 - Risk flags and regional comparisons
 - Integrated directly into the Lovable website
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6. Conversational & Multimodal Interfaces

Internal Voice & Assistant Tool

- **ElevenLabs**
- Functions:
 - Voice-based querying of system insights
 - Multilingual support for staff
 - Internal recommendations and operational guidance
- Intended for **employee and planner use**

Public AI Avatar

- **Anam**
- Fully integrated on the website
- Provides:
 - 24x7 conversational assistance
 - Personalized explanations of healthcare access

- Guidance to real-world support and services
 - Enhances trust, accessibility, and human-centric engagement
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7. Engineering Oversight & Integration

- **Databricks** used for:
 - Code review and debugging
 - Pipeline integration
 - Validation of AI outputs against schema
 - Ensures reliability, reproducibility, and maintainability of the system
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8. Outcomes & Value

- Transforms unstructured medical data into actionable intelligence
 - Identifies medical deserts and coordination gaps
 - Flags unreliable facility claims transparently
 - Enables faster, data-driven healthcare planning
 - Scalable foundation for real-world NGO deployment
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