# LEVL - Longevity Digital Twin Data Visualization

**Company Description:**
LEVL is an AI longevity startup targeting the biology of aging to create novel nutraceutical formulations and personalized protocols to help people live longer, healthier lives.

By leveraging the tools of AI drug discovery to identify synergistic combinations of naturally derived ingredients, certain formulations are emerging that rival the potency of comparable pharmaceuticals without the side effects and regulatory timelines of traditional drug development. Our first Patented formulation using this process mimics fasting-induced cellular rejuvenation without the need for caloric restriction, and in our testing is comparable to the leading anti-aging pharmaceutical, Rapamycin.
We are commercializing these breakthroughs under the LIFESPAN+ brand to deliver foundational cellular support, tackling the root causes of age-related decline while providing immediate functional benefits of Energy, Sleep, Focus, Calm, etc.
Our companion app dynamically optimizes personalized longevity protocols based on users' biomarkers and qualitative feedback, effectively slowing their pace of aging.

Students will directly contribute to developing our open-source longevity knowledge graph, powered by the frontier of aging research and anonymized user data, to democratize anti-aging research in pursuit of LEVL's ultimate mission: Achieve Longevity Escape Velocity, and eliminate age-related disease.

**Preferred Team Size:** 3-5

**Location:** Remote - With virtual access to the team throughout the entire program

**Project Summary:**

Design and implement the unified health data infrastructure behind LEVL's longevity optimization engine. This project intends to create a design forward, aesthetically welcoming central hub where users can seamlessly connect and visualize all of their wearable data, lab results, wellness data, and digital biomarkers to monitor key trends, identify risks, and optimize performance. At its core, the system will compute real-time Biological Age and Pace-of-Aging metrics using powered by open source models and multimodal data —including blood biomarkers, sleep, activity, HRV, DNA methylation, and subjective inputs.

The platform will support LEVL's personalized protocol recommendations and digital clinical testing, allowing users to visualize how specific lifestyle interventions or supplement protocols are affecting their rate of aging. Over time, this system will evolve into a modular digital twin framework, enabling targeted organ-specific insights (e.g., Heart Age, Brain Age), predictive modeling, and adaptive protocol tuning.

**1. Unified Data Layer**

- **Wearable & Sensor Integrations**: OAuth or file-import pipelines for Apple Health, Google Fit, Oura, Garmin, Whoop, Eight Sleep, Strava, CGM, EEG, BP cuffs, ambient light sensors, and bloodwork. Generic CSV/JSON fallback.
- **Plugin-Ready Connector Framework**: Abstract integration layer for future expandability without core rewrites.
  **Raw Sensor Handler**: Normalize and map disparate units/headers into canonical schema. Each metric tagged with:
  - `unit`
  - `source`
  - `trust_score`
  - `provenance_stamp`

**2. Biological-Age & Pace-of-Aging Service**

- **Model Deployment Strategy**: Evaluate trade-offs between on-device and cloud-based estimators. Deploy flexible architecture for both.
- **Model Registry**: Plug-and-play loader for DunedinPACE, PhenoAge, and custom biological clocks.
  **Next-Test Recommender**: Surfaces highest value biomarker or test to improve aging estimate accuracy based on cost/effort tradeoff.

**3. Digital Twin Scaffold**

- **Canonical UserState Object**: Subsystem slots for organ/system-level modeling: cardio-metabolic, neuro-cognitive, immune, musculoskeletal, etc.
- **Event Bus Architecture**: Real-time streaming updates emit `delta` events to downstream analytics engines.
- **Organ-Age Metrics**: Compute specific age estimates (e.g., Heart Age, Brain Age) when relevant data is available.

**4. Data Visualization Layer**

- **Health Hub Dashboard**: Responsive interface with:
  - Trend lines
  - Heatmaps
  - Radar charts
  - Optimal longevity ranges visually coded
- **Interactive Scenario Slider**: Simulate different protocol stacks (fasting, cold exposure, supplements) and show projected biological age curves.
  **Hallmarks of Aging Breakdown**: Decompose biological age into hallmarks (genomic instability, senescence, etc.) and link each to targeted protocols.

- **Longevity Risk Calendar**: Forecast onset risk windows (e.g., frailty at 70) and display time-shifting effects of interventions
- **Aging Twin Explorer**: Compare your trajectory to anonymized “aging twins” or simulate alternate aging futures via protocol deltas.

**5. Protocol Intelligence Engine**

- **Biological Feedback Loop Generator**: Auto-detect improvements or declines and suggest the most likely causal behaviors or inputs.
- **Protocol Efficacy Score**: Score interventions based on their real-world impact on pace-of-aging and biomarker deltas.
- **Supplement Response Tracker**: Structured 2–4 week N-of-1 trials for new compounds or protocols with tracked outcomes and efficacy reports.

**6. API & DevOps**

- **Versioned Internal APIs**: Stable GraphQL/REST endpoints for downstream modules (matching engine, longevity trials, dashboards).
- **Privacy & Consent Framework**: Modular consent architecture for analytics, cloud sync, and research participation.

**Stretch Goals**

- **Federated Learning Readiness**: Enable local gradient updates to centralized models with no raw data transfer.
- **Privacy-First Storage**: End-to-end encryption (including on-device), PII de-identification, granular opt-in controls.
- **Organ-Age Visualizer**: 3D anatomical model with per-organ biological age overlays.
- **Public Leaderboard**: Anonymous ranking by biological age delta in sex/age cohorts.
- **Offline-First Mode**: CRDT-backed local edits with seamless sync once reconnected.

**Scientific Relevance:**

We are advancing the frontier of biological aging quantification by developing one of the most comprehensive and flexible Pace-of-Aging algorithms to date—capable of integrating diverse biomarker, wearable, and lifestyle data in real time. This powers a visually intuitive, user-facing health hub that transforms complex aging science into actionable insights. The system lays a scalable foundation for evaluating longevity protocols and therapeutics in real-world settings, with the potential to become an industry-standard platform for biological age optimization.

**Desired Skill Set:**

Ideal for students excited about building real-world health tech that combines personalized data, biomarker science, and AI-driven insight. Helpful skills include experience with full-stack development (React/Next.js or React Native for UI, Flask or FastAPI for backend), comfort working with structured data (JSON, CSV, or API ingests), and implementing modular scoring

logic in Python. Students interested in biological data, longevity science, or digital health applications will find this project especially rewarding. Bonus if you've worked with wearable data, simple ML models, or health-focused apps, but not required. Tools can be picked up along the way—what matters most is thoughtful system design, clarity in code, and creative problem solving.

**Student Benefits:**

1. Gain hands-on experience with frontier models, scientific literature parsing, knowledge graph construction, and health optimization. Gain experience with startup-style product thinking and stakeholder collaboration.
2. Enjoy creative freedom to design and solve open-ended, high-impact problems that push the frontiers of human life extension.
3. Each team will ship an independent, modular contribution with clear ownership and a path to public demo or open-source release.
4. Top-performing students may be invited to continue working with LEVL or be referred to partner startups in the healthtech and AI space.
5. Complimentary LIFESPAN+ products to improve sleep, boost energy & focus, and mitigate the effects of stress.

**IP Rights:**
Students will be asked to sign a proprietary information and intellectual property assignment agreement. Intellectual property rights to all code, data, and documentation will be retained by LEVL, Inc.

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