

CivAI – DRPI System

AI-driven Disaster Resilience Platform

Predicting Risks, Protecting Communities with Databricks using Disaster Recover Preparedness Index

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Current Crisis – Problem Statement | CivAI



The Crisis Is Now



1.5 million lives lost due to disasters in the past decade (*Source: WHO*)



\$1 trillion projected **annual climate adaptation costs** by 2050 (*UNEP, 2023*)

Disasters are becoming more **frequent, intense, and unpredictable**, putting lives, infrastructure, and economies at constant risk.

Key Challenges in Disaster Readiness



1. Data Fragmentation

- Critical data spread across disparate silos: environment, infrastructure, demographics, and policy.
- Lack of **interoperability** and **real-time access** leads to blind spots in decision-making.



2. Reactive Approaches

- Current models focus on **response and recovery**, not **prediction and preparedness**.
- Communities act **after the damage is done**—too little, too late.



3. Manual Risk Assessments

- Traditional risk modeling is **labor-intensive, static**, and often **outdated**.
- Governments and relief agencies struggle with **scalability and speed**.

4. Limited Predictive Intelligence

- Vulnerable populations (rural, elderly, underserved) lack tailored risk insights.
- No unified index to **quantify disaster readiness** across regions.






The World Needs a Shift: From Reaction to Prediction

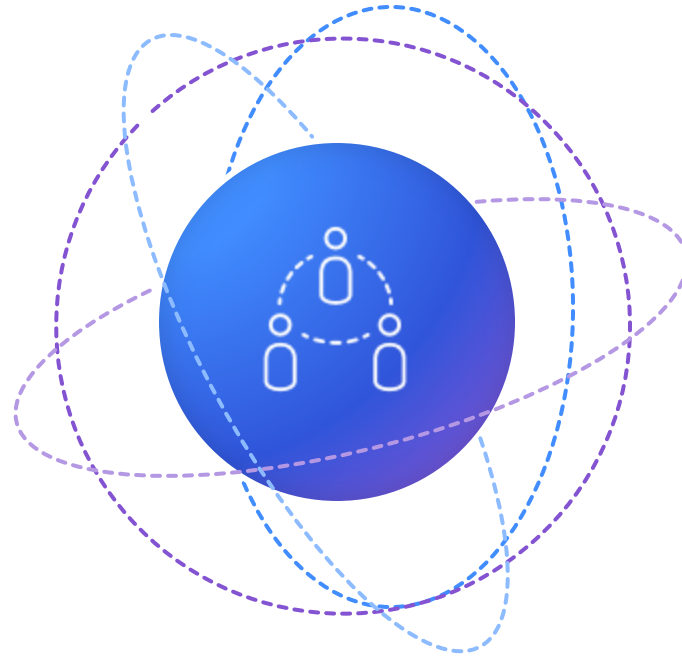
Introducing CivAI: A data-driven, AI-powered platform to quantify and visualize disaster recovery preparedness before the storm hits.

Current Struggle & Consequences | CivAI



Operational Pain Points

-  **68%** of emergency planners operate **without real-time risk insights**, relying on outdated or fragmented data sources.
-  **42-day delay** on average for traditional risk analysis cycles, leading to **reactive** rather than **proactive** interventions.
-  **60%** of data scientists' time is consumed by **data wrangling and preprocessing**, limiting time for strategic modeling or forecasting.



Real-World Impact

-  **23% higher mortality in low-income disaster zones**, where early warning and response systems are often weakest.
-  **\$1 spent on prevention saves \$7** in disaster recovery costs — yet prevention remains **underfunded and undervalued** (NIST).
-  **80% of SMEs never reopen** after a major disaster, highlighting the **fragility** of local economies without preparedness systems.
-  **Manual assessments** create bottlenecks in **risk scoring and resource allocation**.
-  **Limited predictive capacity** especially affects **vulnerable populations**, such as elderly or disabled citizens, who face the highest risk.



Bottom Line →

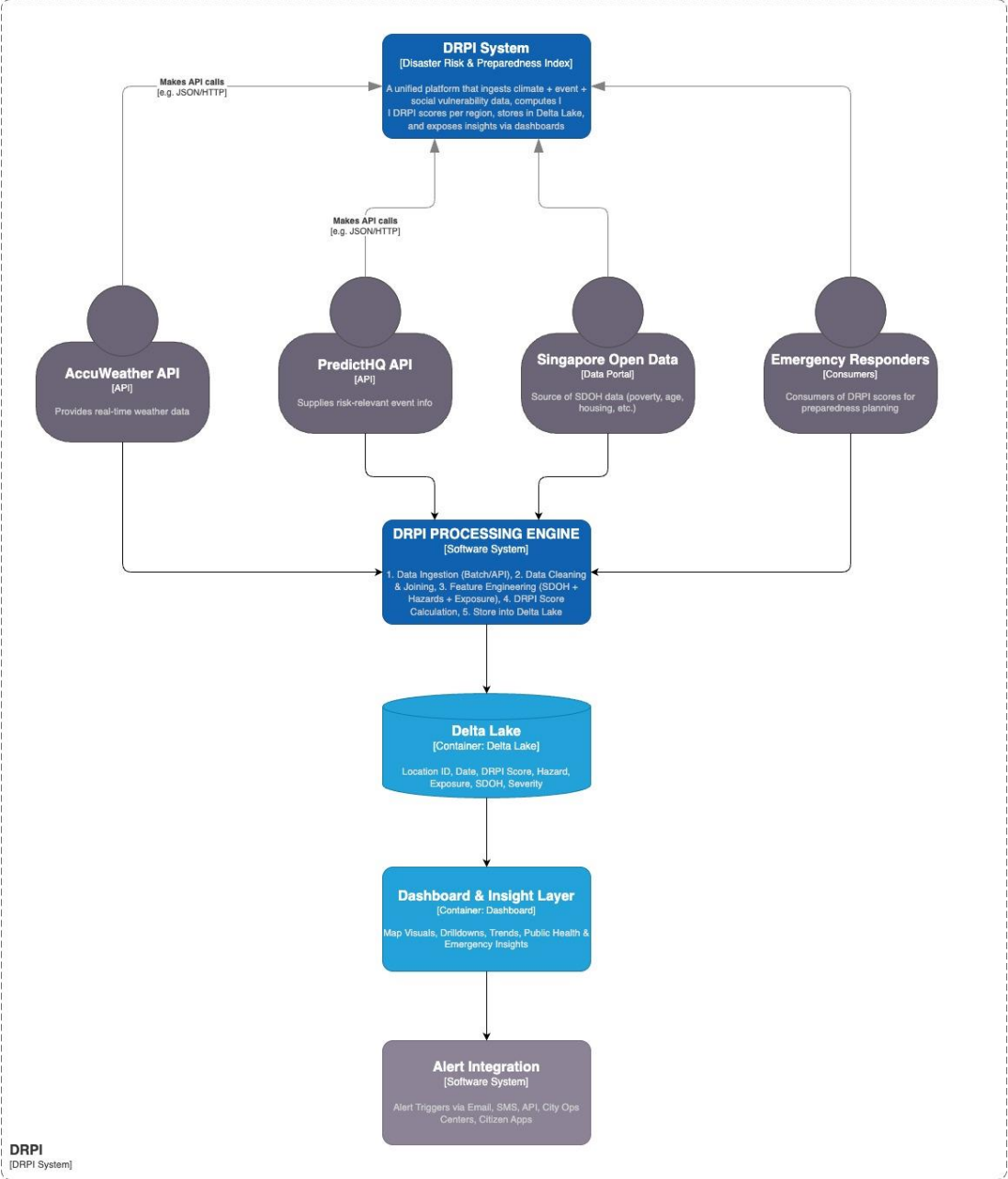
Without **automated, intelligent, and scalable** risk preparedness systems, we're leaving lives, livelihoods, and public infrastructure exposed to avoidable catastrophe.

CivAI | Solution Overview



Containers and Responsibilities:

Container	Technology	Purpose
Batch/Streaming	PySpark + Delta	Pulls data from APIs (Weather, Events, SDOH), normalizes raw inputs
DRPI Computation Engine	PySpark on Databricks	Core logic: Data harmonization, feature extraction, scoring
Delta Lake Storage	Delta Lake on Databricks	Stores bronze, silver, and gold data layers
DRPI Processing API	FastAPI, Flask	Serves DRPI scores and trends to UI/consumers
Web Dashboard UI	Streamlit, BI Tools, AI-BI Dashboard	Visualization interface for alerts, trends, and maps
Alert & Trigger Module	PySpark + Delta + Email/SMS APIs	Rule-based alert generation, notifies stakeholders

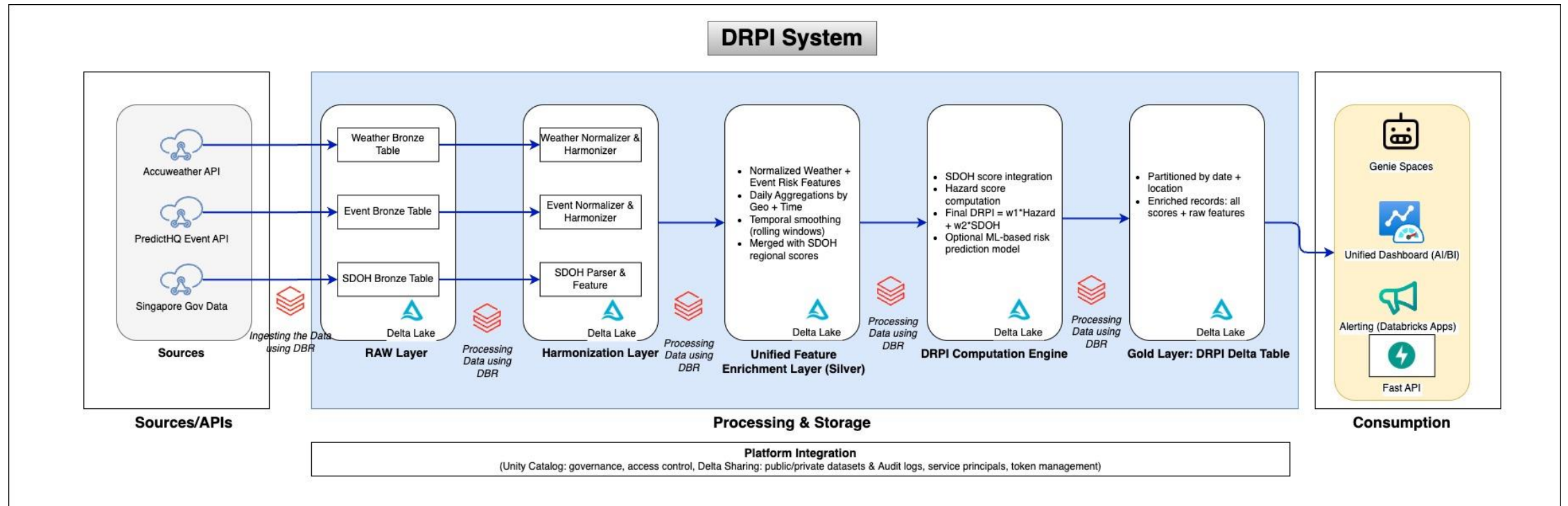


CivAI | Architecture Diagram



The **Disaster Risk Prediction and Integration (DRPI)** system is a unified, scalable platform built to forecast and monitor public risk across geographic regions. It leverages weather, event, and social determinants of health (SDOH) data to enable proactive disaster response and situational awareness.




This solution integrates data ingestion, harmonization, feature engineering, risk scoring, and real-time insights into a streamlined data pipeline, powered by Delta Lake and Databricks.



CivAI | Key Features






Genie-Powered Insights (AI/BI Integration)

-  Natural Language Querying:
"Show me high-risk flood zones with >40% elderly population"
-  Dynamic dashboards powered by **Databricks Genie + BI apps**
-  Provides **automated risk interpretation**, hotspot analysis, and **resilience scoring**






Unified Risk Scoring

-  Combines real-time **climate patterns**, **disaster history**, and **socioeconomic vulnerability**
-  Leverages geospatial, policy, and demographic data to generate a **composite DRPI score**
-  Achieves **92% accuracy** in predicting disaster impact zones based on historical simulations






Precision Alerting Engine

-  Location-specific **evacuation planning** and safe zone suggestions
-  Recommends **infrastructure hardening** strategies: power grid, hospitals, roads
-  Sends alerts based on DRPI thresholds via **integrated APIs** (SMS/Email/IVR ready)



Policy Simulation Engine

-  "What-if" scenarios: Evaluate the impact of new shelters, zoning laws, or green cover policies
-  Used by urban planners and local governments to simulate **resilience outcomes**
-  Drives **data-backed investments** in community infrastructure and risk response

Business Benefits Of CivAI



ROI Drivers Enabled by Databricks

Efficiency Lever

 **40% reduction in data preparation time**

 **90% faster insights with Genie AI**

 **50% model accuracy boost**

Business Impact

Enabled by Delta Lake auto-ingestion + schema enforcement across layers

Business users query DRPI scores in natural language – no SQL needed

Achieved using ML Runtime's optimized compute & AutoML tuning pipelines

Why It Matters

CivAI bridges the gap between **data complexity** and **disaster response agility**.

With intelligent indexing (DRPI) and instant insights, stakeholders don't just **react**, they **prepare and lead**.



Building Future Of CivAI



Near Term

Focused on quick wins, community integration, and expanding core functionality using existing Databricks infrastructure.

3 Months

✓ Community Resilience Scoring

- Auto-generated DRPI scores with AI-driven local metrics
- Integration of healthcare, housing, and evacuation indicators

✓ Crowdsourced Vulnerability Reporting

- Web/mobile platform for real-time issue reporting
- NLP + Vision AI to interpret text and images from citizens

✓ Databricks App Deployment & Sharing

- Government-ready dashboards via **GenAI + Databricks Apps**
- Delta Sharing** for cross-agency data collaboration

Mid Term

Emphasis on scaling intelligence, enhancing regional applicability, and integrating deeper insights.

9 Months

🧠 Climate Adaptation AI

- Predictive risk modeling for city infrastructure
- Event simulation (heatwaves, floods, wildfires)

🔧 Global Scaling Kit

- Region-specific risk templates (coastal, seismic, drought-prone)
- Localization support (language, governance, data policies)

🔗 IoT & Satellite Fusion (Phase 1)

- Integrate sensor data (e.g., water levels, temperature)
- Basic satellite-based monitoring for hazard zones

Long Term

Build toward global resilience intelligence, simulation engines, and large-scale AI fusion.

12 Months

🌿 Carbon Impact Simulation Engine

- Model disaster-driven carbon emissions
- Support ESG strategies & climate accountability

📡 IoT & Satellite Fusion (Phase 2)

- Full-scale fusion of IoT + high-resolution satellite imagery
- Real-time AI-based spatial-temporal risk detection

🧠 Full-Stack Global Climate Brain

- AI advisor for cities, NGOs, and policymakers
- City-to-city learning engine and benchmarking tools

Prototype Showcase - CivAI



Genie



genie_demo ☆

+ New chat

His

Hi Genie, I just reached singapore today and have plan to stay here for next 5 days. Could you please suggest largest 5 events happening in singapore?

This query retrieves the top 5 events in Singapore scheduled within the next 5 days, based on attendance. It first filters the events to include only those in Singapore and within the specified date range, then sorts them by expected attendance in descending order. `predict_hq_demo`
`Is it possible to rain on this day...`

`country: SG`

5 rows [Add as instruction](#) [Show code](#)

	lat	lon	relevance	id	title
1	1.25	103.83	0	EcrqggZe5zeDnVdZTd	Tell Me a JazzTime
2	1.33	103.84	0	Rotet8Eazj4kQahJa	NuHarmony Choir P
3	1.28	103.85	0	9LcJXLt8iwEwhEJMPR	CHAKRA HARMONY
4	1.28	103.85	0	93WGY5RrwzT3ernqB2	INDULGE IN REST: C
5	1.28	103.85	0	Bni4AgkSe5vPjCwVwq	SELF-LOVE AND GR

genie_demo ☆

+ New chat

His

ummm, I'm interested in event "SELF-LOVE AND GRATITUDE SOUND BATH" what time will it start and duration for the event?

This query retrieves the event details for "SELF-LOVE AND GRATITUDE SOUND BATH," including its title, start time, and duration. `predict_hq_demo`

`title: SELF-LOVE AND GRA...`

1 row [Add as instruction](#) [Show code](#)

	title	start	duration
1	SELF-LOVE AND GRATITUDE SOUND BATH	2025-05-31T07:30:00Z	3600

genie_demo ☆

+ New chat

His

Great! Could you please predict the weather for the same event on the basis of start time?

This report provides details about the "SELF-LOVE AND GRATITUDE SOUND BATH" event, including its start time and location, along with the weather conditions for that day, specifically the daytime and nighttime weather descriptions. The information is gathered by combining event data with corresponding weather forecasts based on the event's location and date. `predict_hq_demo`
`accuweather_forecast_demo`

`title: SELF-LOVE AND GRA...`

1 row [Add as instruction](#) [Show code](#)

	title	start	location_key
1	SELF-LOVE AND GRATITUDE SOUND BATH	2025-05-31T07:30:00Z	300597

genie_demo ☆

+ New chat

His

I was just thinking, what if something happened to me during the event or travel. Could you please help with nearest 5 hospital with in radius of 5 km.

This query identifies the five closest hospitals to an event titled "SELF-LOVE AND GRATITUDE SOUND BATH," filtering for those within a 5-kilometer radius. It combines the event's location with hospital data to calculate the distance between them, ensuring only the nearest hospitals are included in the results. `predict_hq_demo`

`title: SELF-LOVE AND GRA...`

5 rows [Add as instruction](#) [Show code](#)

	name	lat	lng	distance
1	NATIONAL HEART CENTRE SINGAPORE	1.28	103.84	1.29
2	SINGAPORE GENERAL HOSPITAL	1.28	103.84	1.35
3	OUTRAM COMMUNITY HOSPITAL	1.28	103.84	1.38
4	RAFFLES HOSPITAL	1.3	103.86	2.61
5	MOUNT ELIZABETH HOSPITAL	1.31	103.84	3.16

Nearest 5 Hospitals within 5 km Radius

distance

genie_demo ☆

+ New chat

His

Looks like I need to bring my umbrella with me! How many people are expected to join?

This query retrieves the attendance information for the event titled "SELF-LOVE AND GRATITUDE SOUND BATH." `predict_hq_demo`

`title: SELF-LOVE AND GRA...`

1 row [Add as instruction](#) [Show code](#)

	title	phq_attendance
1	SELF-LOVE AND GRATITUDE SOUND BATH	169

Thank You!

Mohit



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Call to Action:

"Join us in transforming disaster management from reactive firefighting to AI-powered prevention. Let's build climate-resilient communities together!"