Response Information App – NDRF

A Pathway-powered Live Disaster Response Assistant

Detailed Project Proposal (Hackathon Submission)

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1. Executive Summary

The Response Information App – NDRF is a disaster-response intelligence platform designed to deliver accurate, real-time, and trustworthy information during natural and man-made disasters. Unlike conventional AI systems that rely on static data and uninterrupted internet connectivity, this application is built using the Pathway framework to operate as a Live AI system.

The platform continuously ingests data from authoritative government sources, validates and de-biases incoming information, and powers a Retrieval-Augmented Generation (RAG) engine that provides evidence-based responses. A key differentiator of this system is its offline-first design, ensuring critical guidance reaches responders and citizens even during communication blackouts.

2. Problem Statement

Disaster response operations frequently suffer from information breakdowns caused by network outages, fragmented data sources, and outdated or contradictory advisories. Emergency responders often rely on multiple documents such as SOPs, circulars, and advisories that may not be synchronized or updated consistently.

Existing AI-based assistants fail in such environments because they depend on static datasets and continuous cloud connectivity. This creates a critical gap where timely, accurate, and trustworthy information is unavailable when it is needed the most.

3. Objectives

The primary objectives of the Response Information App – NDRF are:

• Build a live, always-updated disaster information system using Pathway
• Eliminate misinformation through strong validation and bias mitigation
• Detect conflicts across policies, SOPs, and advisories
• Enable offline-first access for responders and citizens
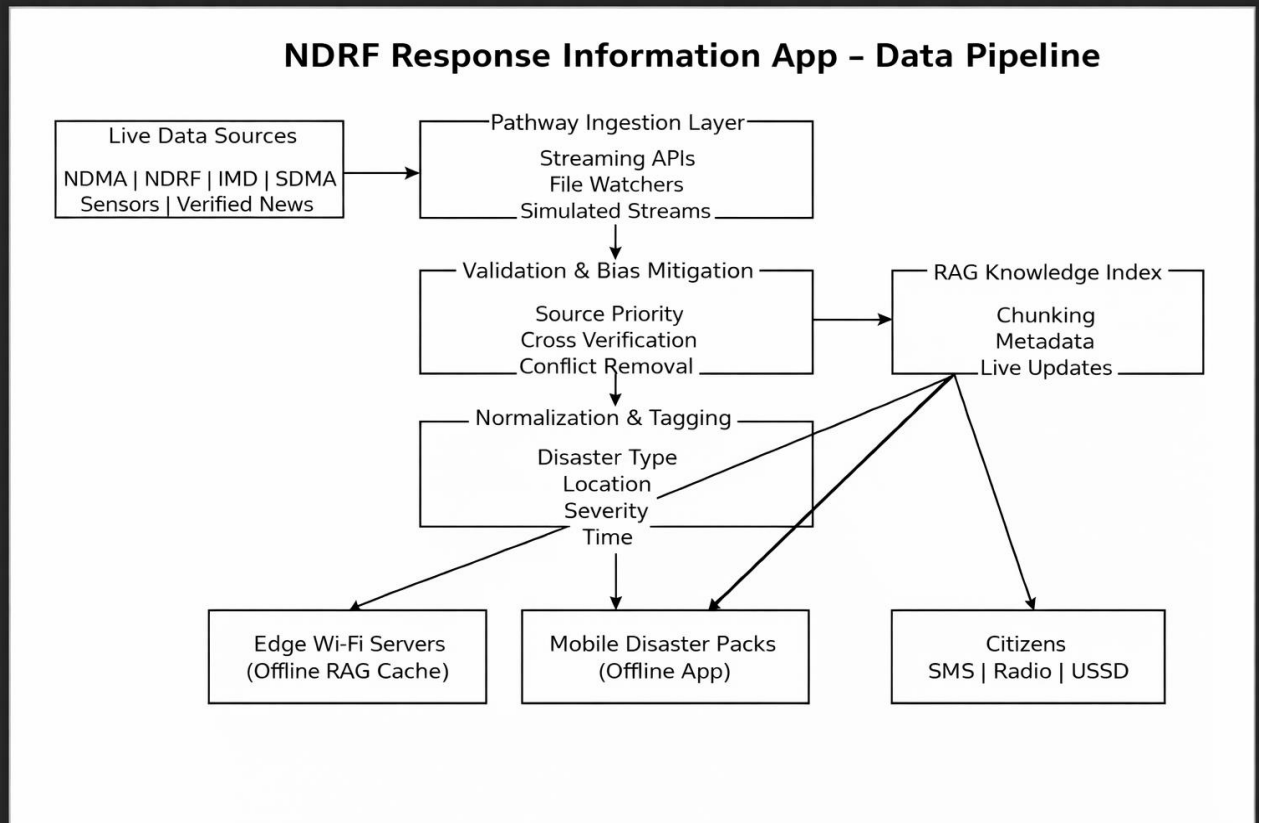• Deliver explainable, evidence-backed AI responses

4. System Architecture Overview

The system architecture is centered around a Central Pathway Engine deployed at headquarters. This engine continuously processes live data streams, performs validation and transformation, and maintains an up-to-date RAG knowledge index.

Processed intelligence is distributed across multiple access layers including edge Wi-Fi

servers, mobile disaster response applications, and low-bandwidth channels such as SMS, USSD, and radio.

Figure 1: High-Level Data Pipeline and RAG Architecture

NDRF Response Information App – Data Pipeline

Live Data Sources

NDMA | NDRF | IMD | SDMA
Sensors | Verified News

Pathway Ingestion Layer

Streaming APIs
File Watchers
Simulated Streams

Validation & Bias Mitigation

Source Priority
Cross Verification
Conflict Removal

RAG Knowledge Index

Chunking
Metadata
Live Updates

Normalization & Tagging

Disaster Type
Location
Severity
Time

Edge Wi-Fi Servers
(Offline RAG Cache)

Mobile Disaster Packs
(Offline App)

Citizens
SMS | Radio | USSD

5. Knowledge Base Design (Rahul)

The knowledge base forms the foundation of the RAG system. It is designed to store both structured and unstructured disaster-related information. Documents are intelligently chunked and enriched with metadata such as disaster type, geographic location, severity level, and timestamp.

Unlike traditional static knowledge bases, this system remains continuously updated through Pathway's incremental processing, ensuring that outdated information is automatically superseded.

6. RAG Model Workflow (Rahul)

When a user submits a query, the system first analyzes intent and context. Relevant document chunks are retrieved from the live knowledge index and supplied to the language model.

The model generates responses grounded strictly in retrieved evidence, reducing hallucinations and ensuring trustworthiness. Any updates in source documents are immediately reflected in subsequent responses.

7. Data Ingestion and Streaming (Yashodeep)

The data ingestion layer is implemented entirely using Pathway connectors. All inputs— APIs, PDFs, reports, and simulated real-time feeds—are treated as continuous streams.

Pathway automatically detects additions, updates, and deletions in source data without requiring system restarts. This enables the platform to function as a true Live AI pipeline.

8. Data Sources and Validation (Aditya)

Primary data sources include NDMA, NDRF, IMD, State Disaster Management Authorities, and other official government bodies. Supporting sources such as open data portals and verified news feeds are used with lower priority.

Validation mechanisms include source credibility scoring, cross-verification across multiple authoritative sources, duplicate detection, and conflict identification.

9. Network, Security, and Compliance (Saanidhi)

The system is designed for degraded and disconnected network environments. Secure synchronization mechanisms ensure that data integrity is preserved across edge deployments.

Encryption at rest and in transit, role-based access control, and compliance with national data governance standards are integral to the system design.

10. Storage and Compute Infrastructure

The platform employs a multi-layered storage strategy. Structured metadata is stored in relational databases, unstructured documents in object storage, and semantic embeddings in vector indexes.

Compute resources are optimized for incremental recomputation, minimizing processing cost while maintaining real-time responsiveness.

11. Embedding Strategy

Documents are embedded after intelligent chunking. Metadata-aware embeddings enable filtering by location, time, and disaster type.

Only modified or newly added documents are re-embedded, ensuring efficient use of compute resources.

12. Scalability and Fault Tolerance

Pathway's execution model supports horizontal scalability and fault tolerance. The system continues operating during partial failures and automatically recovers when connectivity is restored.

Edge deployments ensure uninterrupted access during large-scale disasters.

13. Expected Outcome

The expected outcome is a working prototype demonstrating live data updates, automatic conflict detection, offline access, and reliable AI-driven disaster guidance.

The project highlights how Pathway can power mission-critical AI systems.

14. Business Canvas (Rahul)

Key stakeholders include disaster response agencies, state governments, and emergency services. The core value proposition is reliability during crises.

The solution can be deployed as a government-funded public safety platform or a managed service.

15. Conclusion

The Response Information App – NDRF represents a new class of disaster-resilient AI systems. By combining Pathway's live data processing with a robust RAG architecture, the

platform ensures that accurate information reaches those who need it most—even when networks fail.