ReliefFlow Dashboard: A SQL-Driven Disaster Management and Coordination Solution

Academic Report

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A Comprehensive Analysis of Database Design, Data Entry Processes, and Power BI Visualization

Abstract

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ReliefFlow Dashboard represents an innovative approach to disaster response coordination, leveraging a relational database and Power BI visualizations. This report elucidates the project's overview, database schema, data entry mechanisms, and the multifaceted Power BI dashboard, ensuring a robust framework for managing resources, volunteers, and organizational efforts during crises.

1 Introduction

The ReliefFlow project addresses the critical need for efficient disaster response management. By integrating a SQL database with Power BI, it provides real-time insights into resource allocation, volunteer coordination, and disaster impact across global regions. This report details the project's structure, implementation, and analytical capabilities.

2 Project Overview

Project Highlights

ReliefFlow is designed to streamline disaster response by centralizing data on disasters, resources, volunteers, and organizations. Key achievements include the development of a relational database with 23 tables, automated triggers for data consistency, and a Power BI dashboard with three interactive pages: **Overview**, **Resource & Logistics**, and **People & Coordination**. The system supports 1 million allocated resources and 6 deployed volunteers as of May 2025.

3 Database Schema and Table Relationships

Establishing a relational database to manage disaster response data, involving creating and linking multiple tables for efficient data storage and retrieval.

3.1 Table Descriptions

- **DisasterEvent**: Stores disaster details (e.g., Hurricane Katrina) with attributes like Type, Severity, and Dates.
- **Location**: Captures geographic data (e.g., New Orleans) with Latitude and Longitude.
- **ReliefOrganization**: Lists organizations (e.g., Global Relief Fund) with contact information.
- **Participant**: Tracks individuals (e.g., John Doe) with roles and availability.
- **SkillType**: Defines skills (e.g., First Aid) relevant to response efforts.
- **VolunteerSkills**: Links volunteers to their skills and proficiency levels.

- **ResponseTeam**: Manages teams (e.g., Team Alpha) with specializations.
- **Resource**: Catalogs resources (e.g., Canned Food) with quantities.
- **ResourceAllocation**: Tracks resource distribution to disasters.
- **DisasterAffectedRegion**: Maps disasters to affected locations.
- **DisasterVolunteerAssignment**: Assigns volunteers to disasters.
- **DisasterResponseTeamAssignment**: Deploys teams to disasters.
- **TeamCoordination**: Facilitates team-to-team communication.
- **Lookup Tables (RoleType, ResourceType, SkillLevelType)**: Provide standardized categories.

3.2 Relationships

The schema employs primary and foreign keys for relationships: - **One-to-Many**: DisasterEvent to DisasterAffectedRegion, ReliefOrganization to ResponseTeam. - **Many-to-Many**: Participant to SkillType via VolunteerSkills, DisasterEvent to Resource via ResourceAllocation.

4 Data Entry Process

Initiating data population by inserting initial records into lookup tables, followed by core entity tables, and finally coordination and assignment tables, ensuring data integrity through triggers.

4.1 Step-by-Step Process

1. **Initialize Lookup Tables**: Populate RoleType, ResourceType, and SkillLevelType with predefined values.
2. **Populate Core Tables**: Insert data into Location, ReliefOrganization, Participant, ResponseTeam, Resource, and SkillType.
3. **Assign Relationships**: Link volunteers to skills (VolunteerSkills), participants to teams (TeamMember), and organizations to regions (OrganizationRegion).
4. **Record Disasters**: Add DisasterEvent records with affected regions.
5. **Assign Resources and Personnel**: Use ResourceAllocation, DisasterVolunteerAssignment, and DisasterResponseTeamAssignment to deploy assets.
6. **Coordinate Efforts**: Log communications via TeamCoordination, VolunteerTeamCoordination, etc.
7. **Trigger Automation**: Triggers update availability (e.g., Participant.AvailabilityStatus) and resource quantities upon insertions/deletions.

5 Power BI Dashboard Analysis

Visualizing data through an interactive dashboard, segmented into three pages for comprehensive analysis.

5.1 Page 1: Overview

Overview Dashboard

Purpose: Provides a high-level summary of disaster response activities. **Components**:

- **Title**: "Disaster Response Analytics" with KPIs for TotalDisasters, ActiveDisasters, VolunteersDeployed, and ResourcesAllocated.
- **Slicers**: Filter by Disaster Type, Severity, Year, and Organization.
- **Map**: Displays resource allocation and disaster severity globally.
- **Stacked Column Chart**: Tracks disaster types by year.

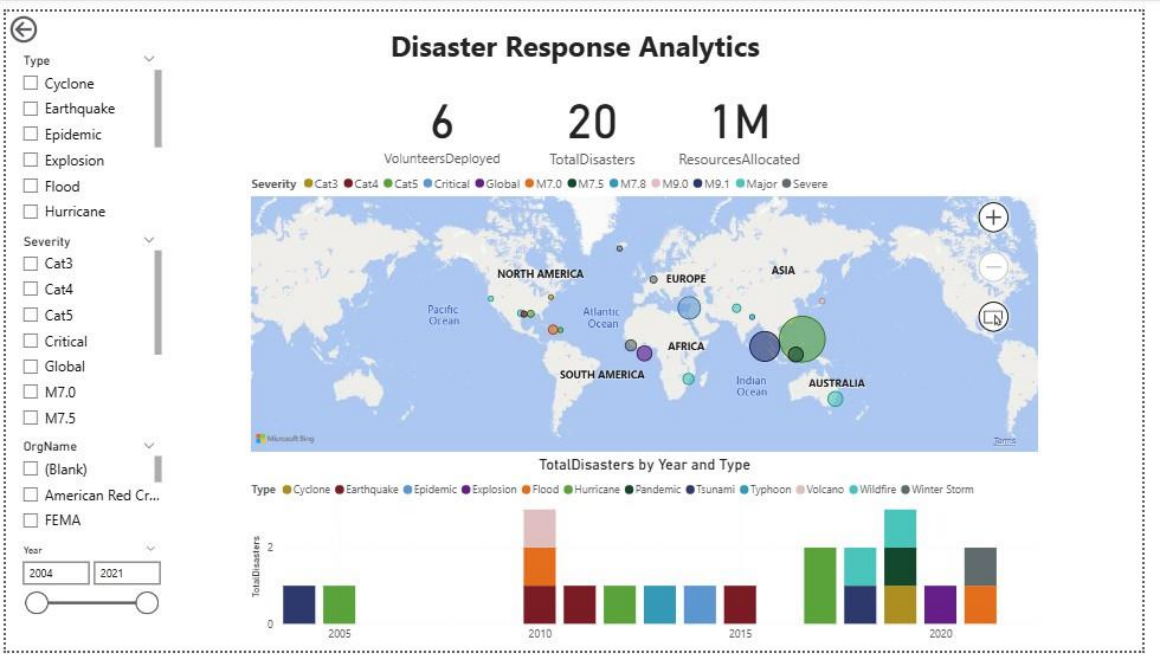

Figure 1: Overview Dashboard Visualization

5.2 Page 2: Resource & Logistics

Resource & Logistics Dashboard

Purpose: Focuses on resource management and allocation status. **Components**:

- **Slicers**: Filter by Disaster Type and Organization.
- **Clustered Bar Chart**: Shows resource quantities by disaster.
- **Donut Chart**: Illustrates allocation status (e.g., 99.93% Completed).
- **Matrix**: Details resource distribution by organization and type.
- **Line Chart**: Depicts cumulative resources by year.

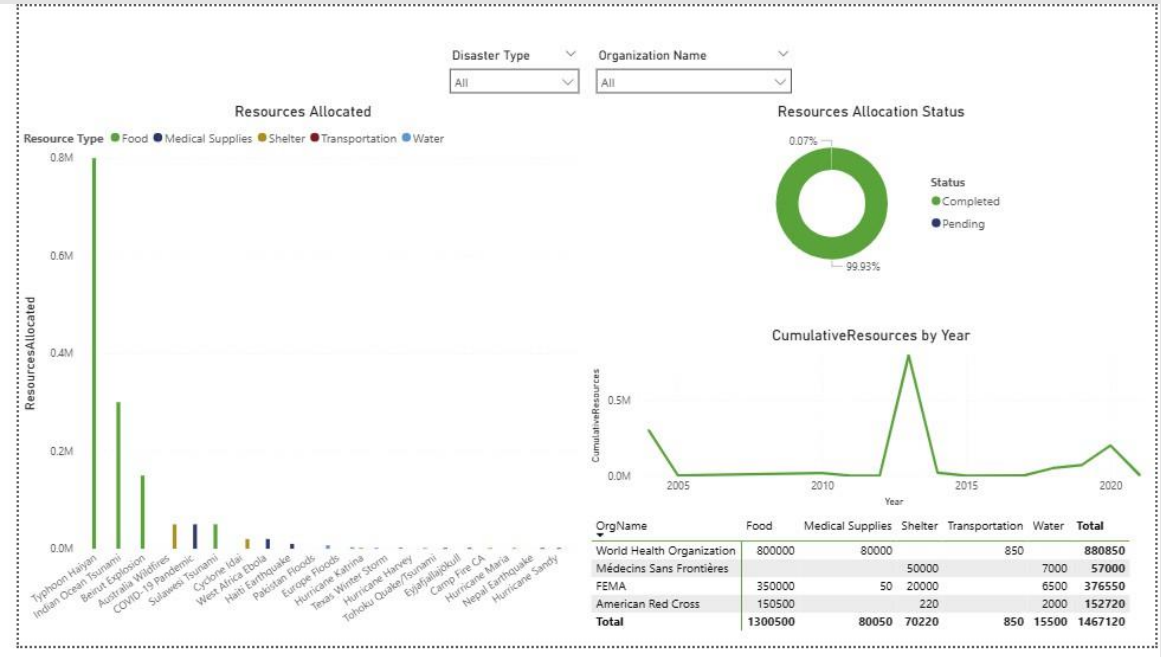

Figure 2: Resource & Logistics Dashboard Visualization

5.3 Page 3: People & Coordination

People & Coordination Dashboard

Purpose: Analyzes volunteer deployment and coordination. **Components**:

- **Slicers**: Filter by Disaster Name and Response Team.
- **Clustered Bar Chart**: Displays volunteers per skill.
- **Stacked Bar Chart**: Shows assignment durations by role.
- **Coordination Table**: Lists team communications with read status.
- **Card**: Highlights available volunteers.

Figure 3: People & Coordination Dashboard Visualization

6 Conclusion

Conclusion

ReliefFlow Dashboard exemplifies a sophisticated integration of database management and data visualization, offering actionable insights for disaster response. Its scalability and interactivity position it as a benchmark for future humanitarian efforts.

7 Recommendations

- Enhance real-time data feeds for immediate updates.
- Expand volunteer training modules based on SkillType analytics.

- Integrate predictive analytics for resource pre-allocation.