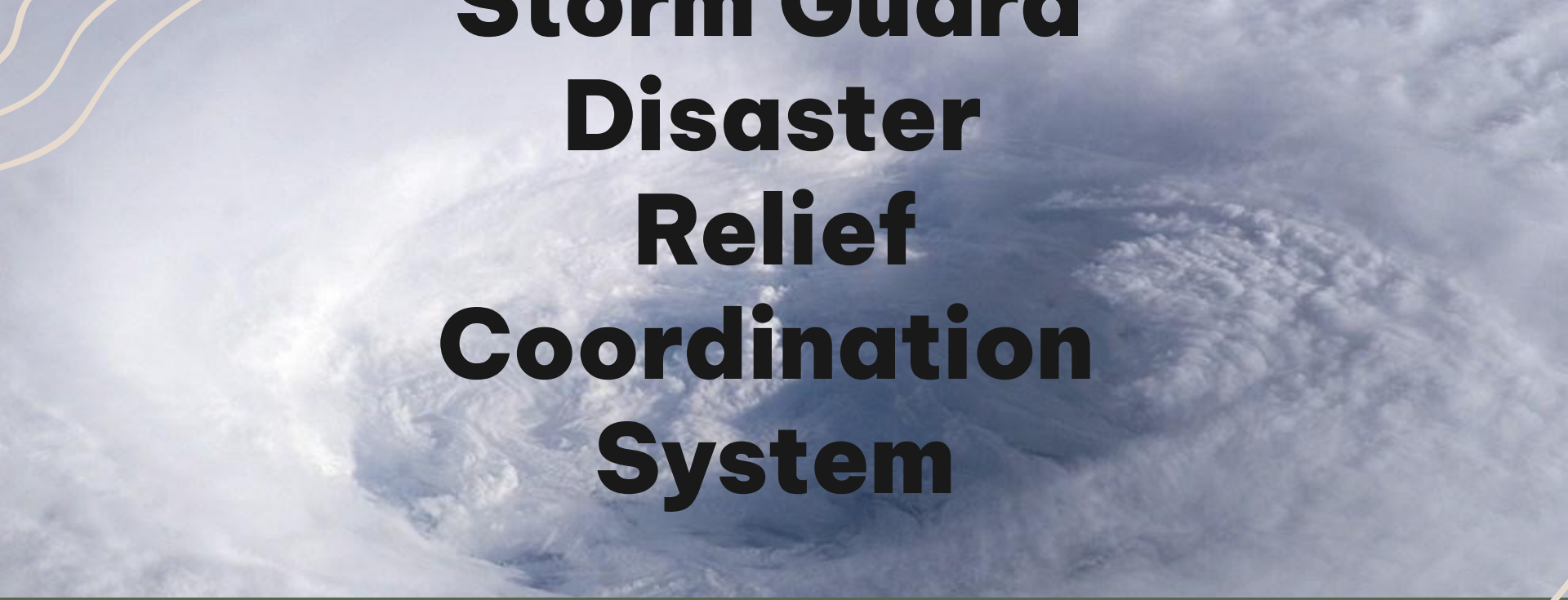
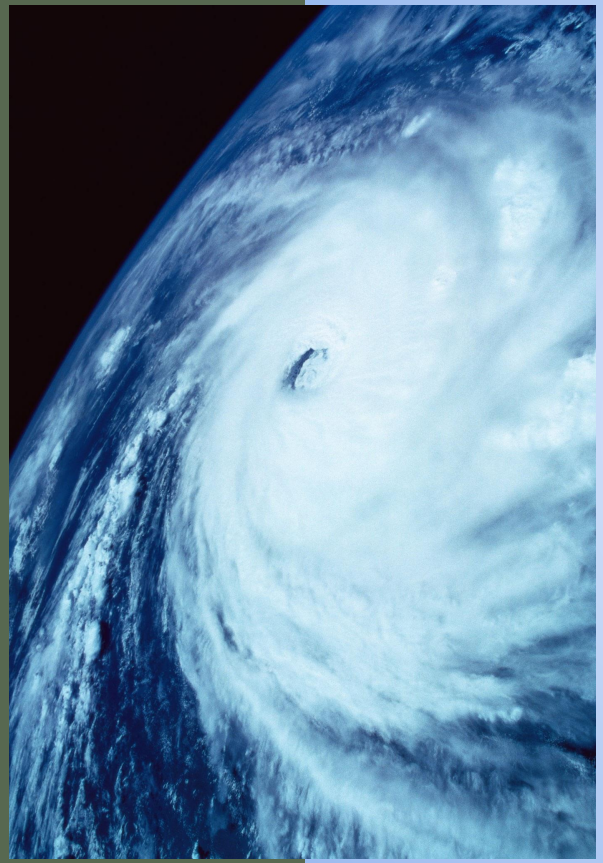


Storm Guard Disaster Relief Coordination System

By: Nivedita Prabhu, Ayodeji Adeogun, Nicholas Scott Marshall



Team Members

Nivedita Prabhu

ER Diagram, Database Creator/Manager, and Template Support

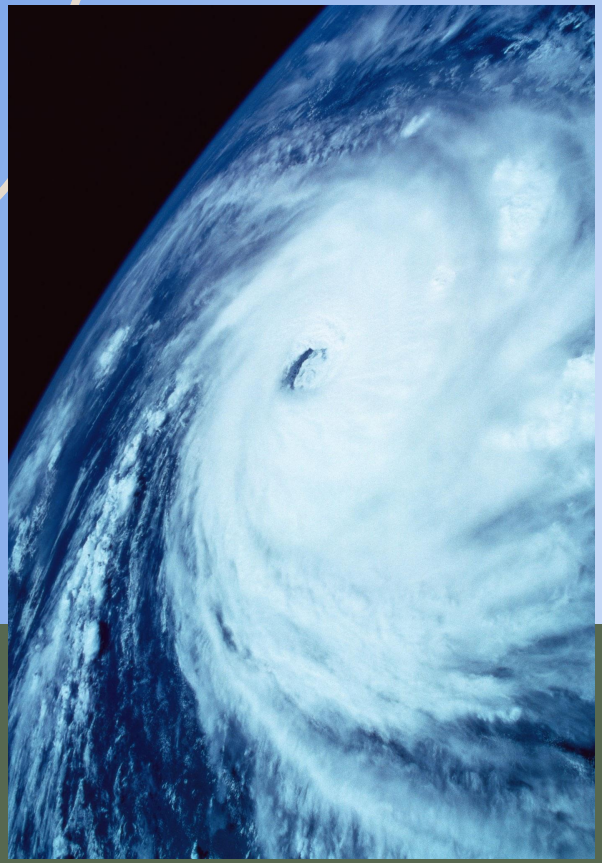
Ayodeji Adeogun

Research and Database Manager

Nicholas Scott Marshall

Relational Schema and Database Manager

TABLE OF CONTENTS



01

Introduction

Problem Statement:

- Addresses limitations of Excel in disaster response information management.
- Identifies main data points for tracking: resources, affected areas, personnel.
- Designs a database schema for data integrity through primary and foreign keys.
- Establishes SQL database for handling large data amounts and real-time, concurrent access.
- Leverages SQL's strong querying feature for complex data retrieval, analysis, and reporting.
- Optimizes data integrity for decision-making in disaster relief.

Target Users and Roles

Hurricane Relief Coordinators (Admin Users):

- Oversees disaster relief process, resource allocation, logistics, and personnel management.
- Views data for situation examination, resource allocation tracking, and detailed reports.
- Inserts, updates, and modifies data on resources, individuals, and affected areas.
- Provides full read, write, and update access to system modules.

Field Volunteers:

- Implement grassroots operations, including supplying, aiding those affected, and posting the status of activities.

Logistics and Supply Chain Managers:

- Coordinate and control resources, supplies, and logistics.
- Make timely delivery to affected locations.
- Requires up-to-date information on resources, inventory, and distribution status.
- Requires reporting facilities for resource movement tracking.
- Allows read and write access to inventory and distribution records.

Requirements

Location-Based Data Access

Lists of affected locations, stocked resources, and tasks assigned. They need to be capable of reporting task completion in real time as well.

Needs

Information access regarding populations affected, drugs, and patient files (if accessible). Need to be updated in medical treatment as well based on reports.

Responsibilities

Provide medical care to disaster victims, i.e., field hospitals or open-field clinics.

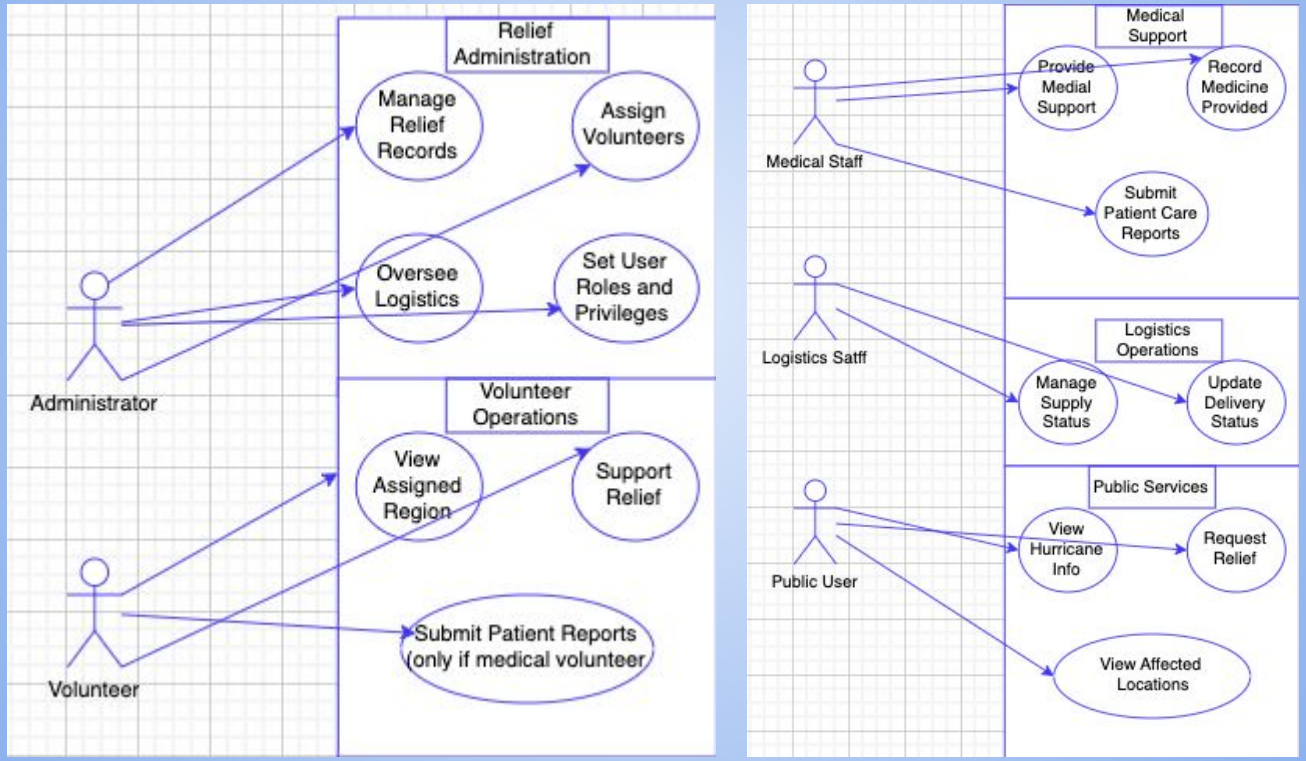
Privilege of Access

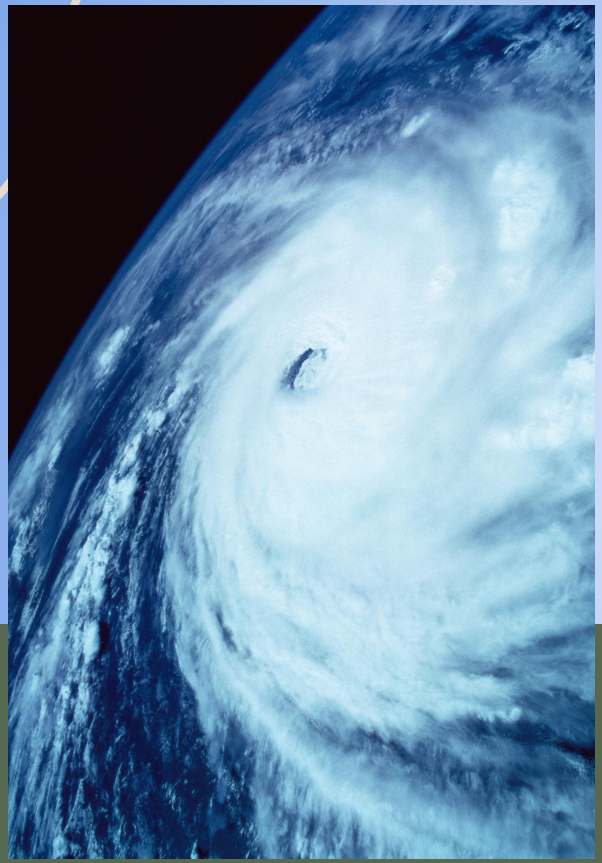
Read-only access to data for relevant task information and location-based data. They cannot delete or modify data but can report the status of completed tasks.

Access Privileges

Read and write privileges on patient care reports and medical history. No access to staff or logistics information except to health needs. Database Administration will install and maintain the SQL database. The DBA will guarantee that the database is running smoothly, securely, and reliably throughout the disaster recovery.

Use Case Diagram





02

ER Diagram

Overview

Overall Entities

Hurricane, Country, Relief, Volunteer, Logistics (weak), Medical Support (weak), and Administration (weak)

Weak Entities and Hierarchies

LOGISTICS is a weak entity since it depends on RELIEF.
MEDICAL SUPPORT is specialized in RELIEF.
ADMINISTRATION is specialized from VOLUNTEER, as administrators have elevated privileges.

Assumptions

Each RELIEF operation is uniquely identified by relief_id.
VOLUNTEERS are assigned per region and cannot operate in multiple regions simultaneously.
LOGISTIC operations are strictly dependent on RELIEF efforts and cannot exist independently.

Relations and Cardinality:

Hurricane Affects Country (1:M)

One hurricane can impact multiple countries, but each country is affected by one hurricane at a time.

Country Requests Relief (M: N)

A country may request multiple types of relief, and each relief operation may serve multiple countries.

Relief Requires Logistics (1:M)

(Weak Entity Dependency) - Each relief effort requires logistics, but logistics exist only if associated with relief efforts.

Medical Support is a Specialized Type of Relief

(Generalization/Specialization in EER) - Some relief efforts are medical-related and require additional attributes.

Volunteer Supports Relief (M: N)

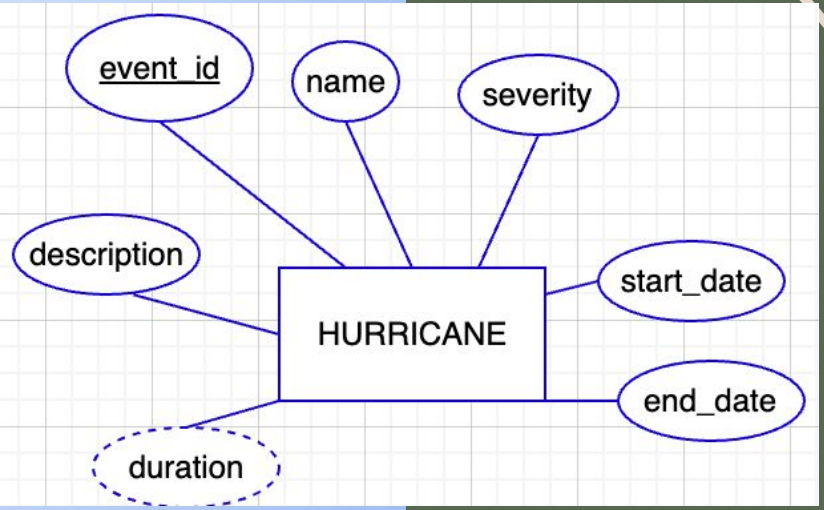
Volunteers are assigned to relief efforts, and each relief effort can have multiple volunteers.

Administration Manages the Database (1:M)

Administrators oversee relief coordination, logistics, and volunteer assignments.

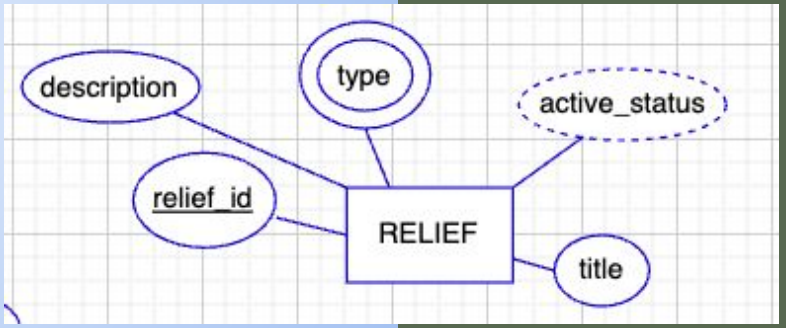
Hurricane

- event_id (Presumably the primary identifier for a specific hurricane event)
- name (The name given to the hurricane)
- description (A textual description of the hurricane)
- severity (The intensity or category of the hurricane)
- start_date (The date when the hurricane began)
- end_date (The date when the hurricane ended)
- duration (The length of time the hurricane lasted)



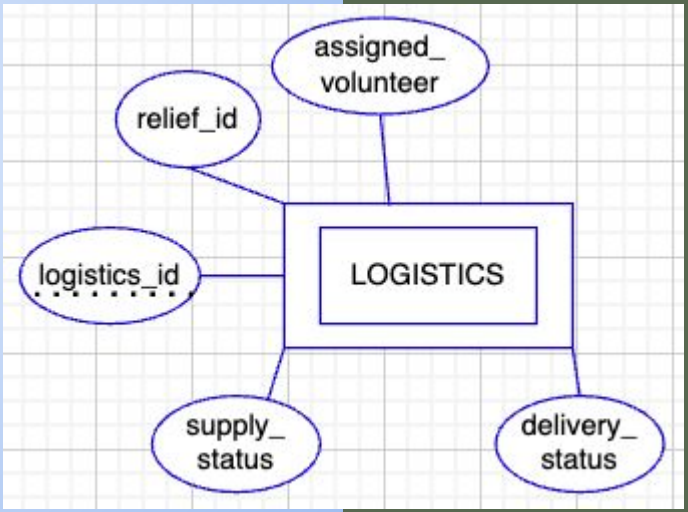
Relief

- relief_id (Presumably the primary identifier for a specific relief effort or task)
- description (A textual description of the relief effort)
- type (The category or kind of relief being provided, e.g., shelter, food, water)
- active_status (Indicates whether the relief effort is currently active)
- title (A name or title given to the relief effort)



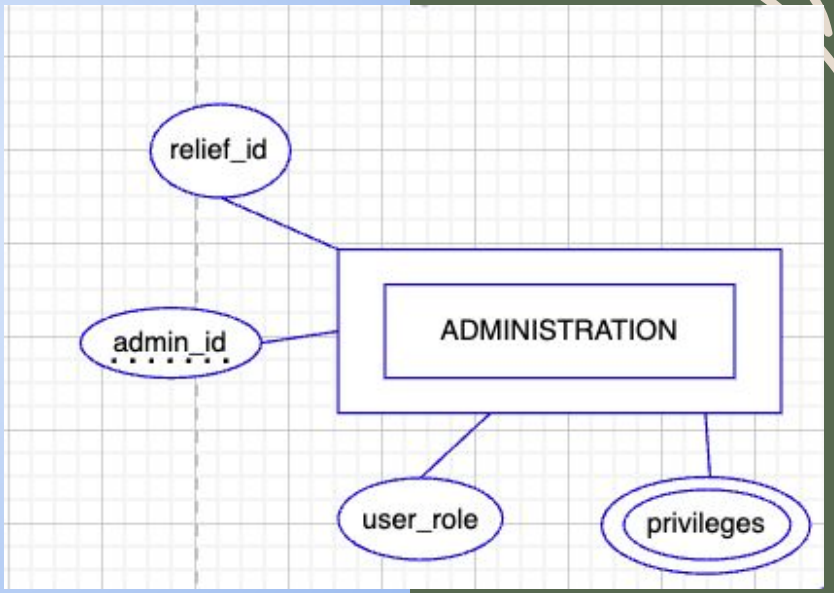
Logistics

- logistics_id (Presumably the primary identifier for a specific logistical operation)
- supply_status (The current status of the supplies involved in the logistics)
- delivery_status (The current status of the delivery process)



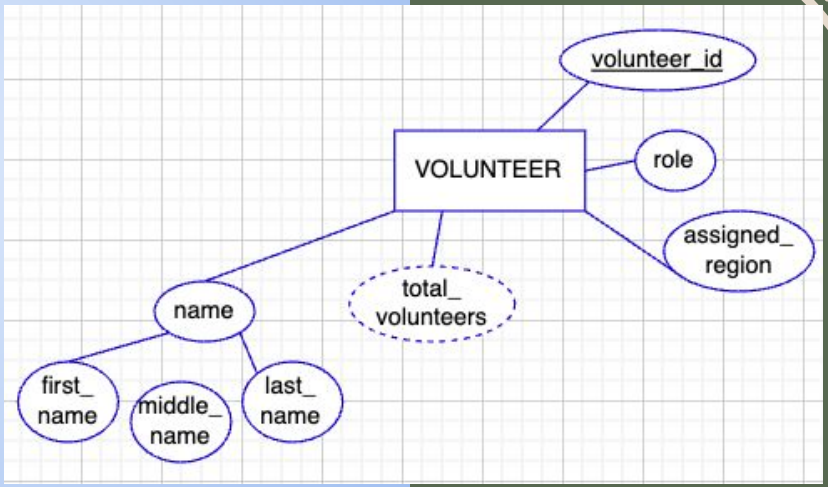
Administration

- admin_id (Presumably the primary identifier for an administrative record or user)
- user_role (The role or position of the administrative user)
- privileges (The permissions or access rights of the administrative user)



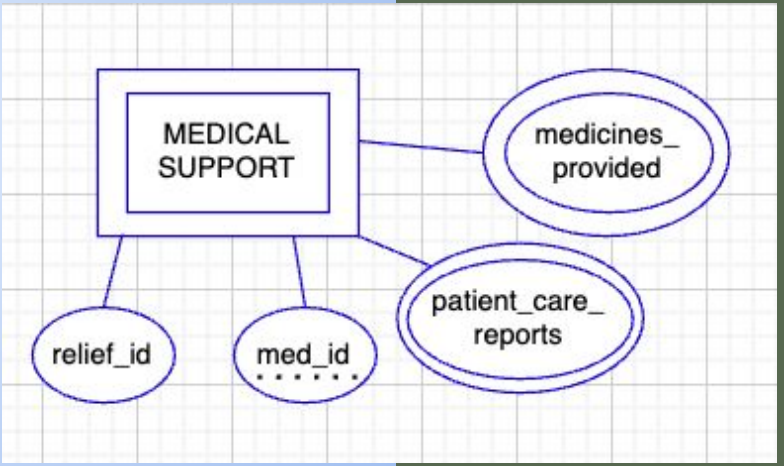
Volunteer

- volunteer_id (Presumably the primary identifier for a specific volunteer)
- name (An attribute that appears to be composed of first_name, middle_name, and last_name)
- role (The specific task or duty assigned to the volunteer)
- assigned_region (The geographic area where the volunteer is assigned)
- total_volunteers (This seems like it might be a derived attribute or a count, rather than a property of an individual volunteer)



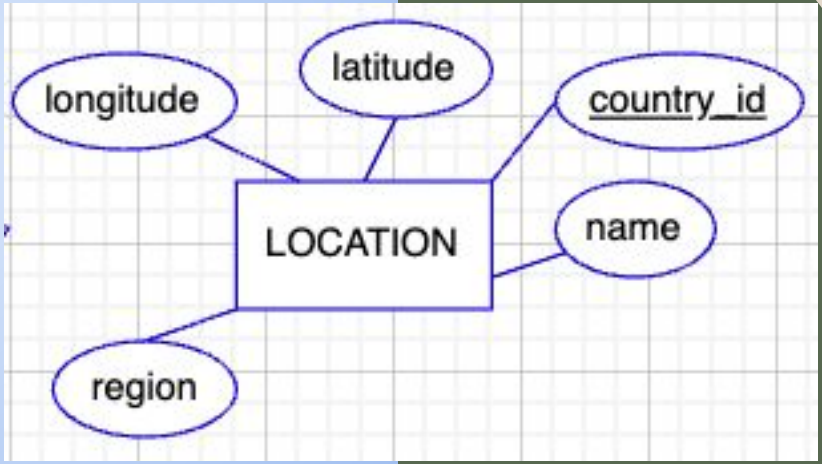
Medical Support

- med_id (Presumably the primary identifier for a specific medical support record or instance)
- medicines_provided (Information about the medications or supplies given)
- patient_care_reports (Records or summaries of medical care provided to patients)

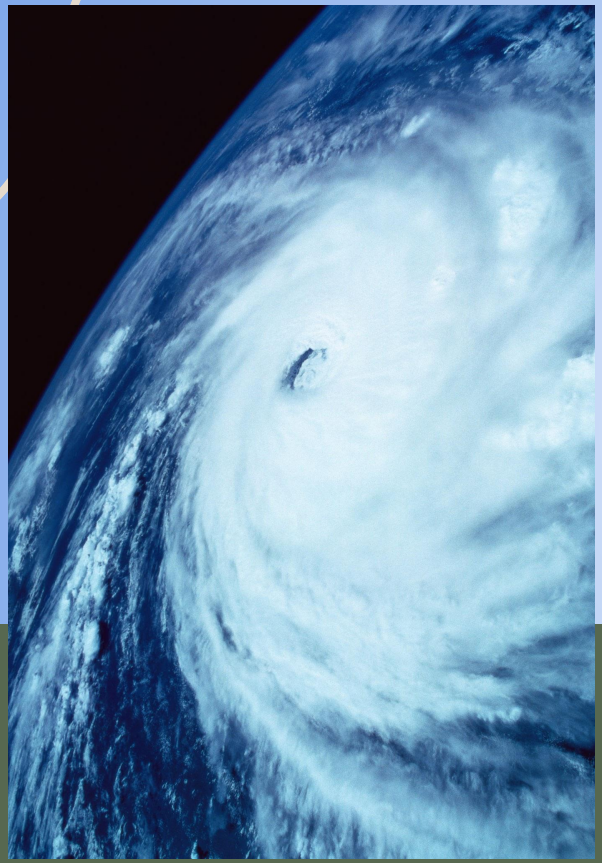


Location

- location_id (Presumably the primary identifier for a specific location)
- longitude (The east-west geographic coordinate)
- latitude (The north-south geographic coordinate)
- country_id (Identifier for the country the location is in)
- name (The name of the location)
- region (The broader geographic region the location belongs to)




longitude
latitude
country_id
event_id
name
severity
AFFECTS
M
LOCATION
name
region
description
HURRICANE
start_date
end_date
duration
1
N
REQUESTS
M
description
type
active_status
relief_id
RELIEF
title
1
assigned_
volunteer
relief_id
REQUIRES
M
logistics_id
LOGISTICS
supply_
status
delivery_
status
M
OVERSEES
M
MANAGES
N
SUPPORTS
MEDICAL
SUPPORT
medicines_
provided
patient_care_
reports
relief_id
med_id
1
1
relief_id
admin_id
ADMINISTRATION
user_role
privileges
M
volunteer_id
VOLUNTEER
role
assigned_
region
name
total_
volunteers
first_
name
middle_
name
last_
name



03

Relational Diagram

Relationals

Hurricane

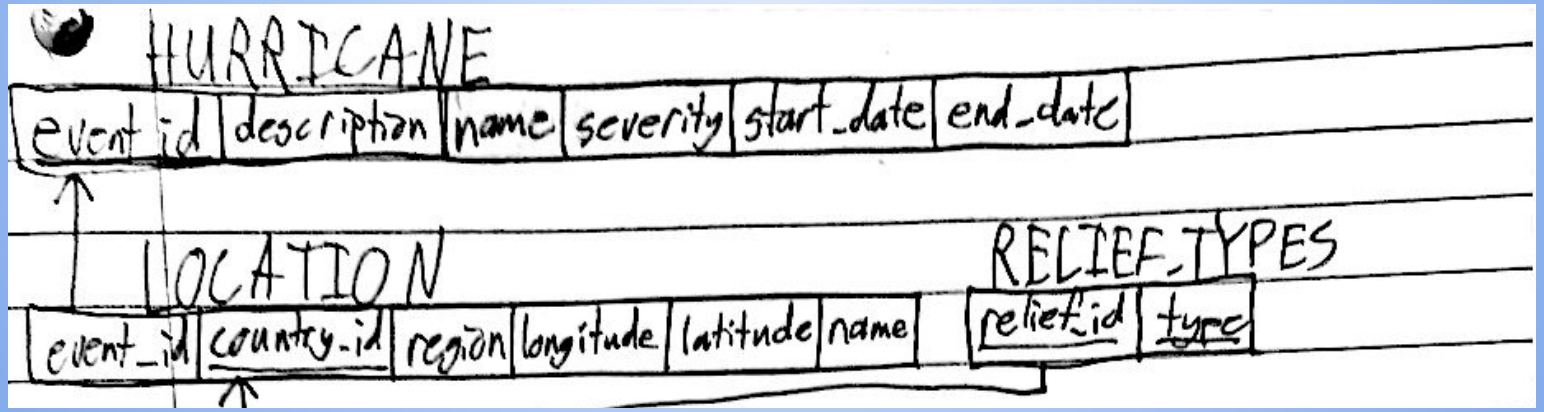
event_id - primary key
description - description of hurricane
name - name of hurricane
severity - severity of storm
start_date - start date
end_date - end date

Location

event_id - relevant hurricane
country_id - primary key
region - part of the country
longitude - exact e/w coords
latitude - exact n/s coords
name - country name

Relief Types

relief_id - part of the primary key
type - distinguishes from different types given the same relief_id, making it part of the primary key



Relationals

Requests

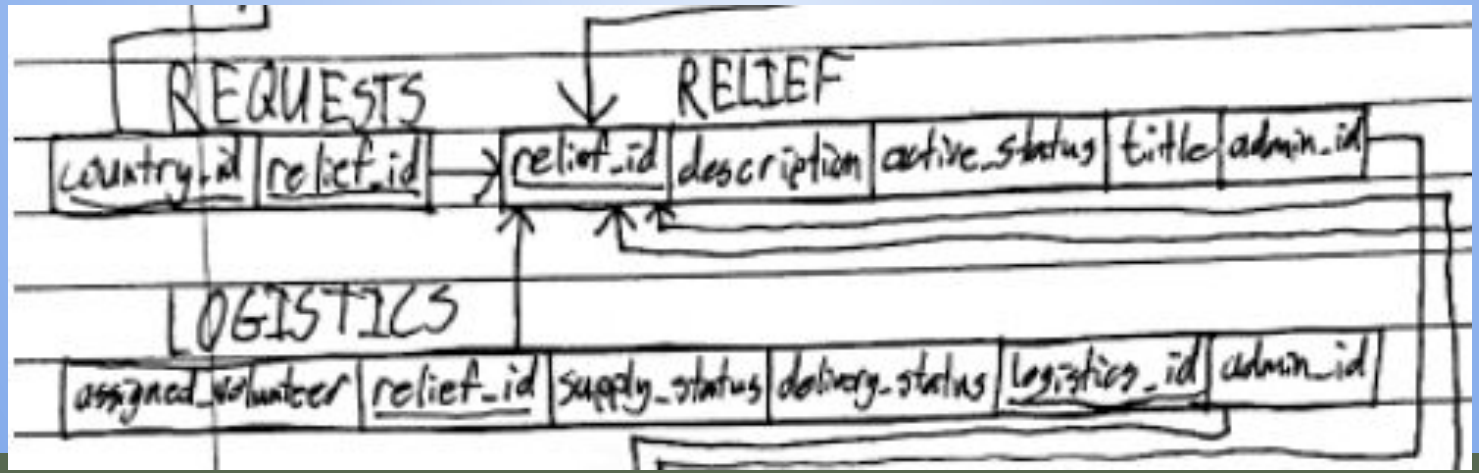
country_id - part of the primary key relative to location
relief_id - part of the primary key relative to relief

Relief

relief_id - primary key
description - description of the relief
active_status - true/false
title - name of the relief
admin_id - admin the relief is linked to

Logistics

assigned_volunteer - volunteer placed in charge
relief_id - secondary key
supply_status - status of supplies
delivery_status - status of delivery
logistics_id - primary key
admin_id - admin of this instance



Relationals

Administration

user_role - role the admin plays
volunteer_id - secondary key to the parent table (volunteer)
admin_id - primary key

Medical Support

med_id - part of primary key relative to the medicines provided table
relief_id - part of primary key relative to the relief table

Relationals

Volunteer

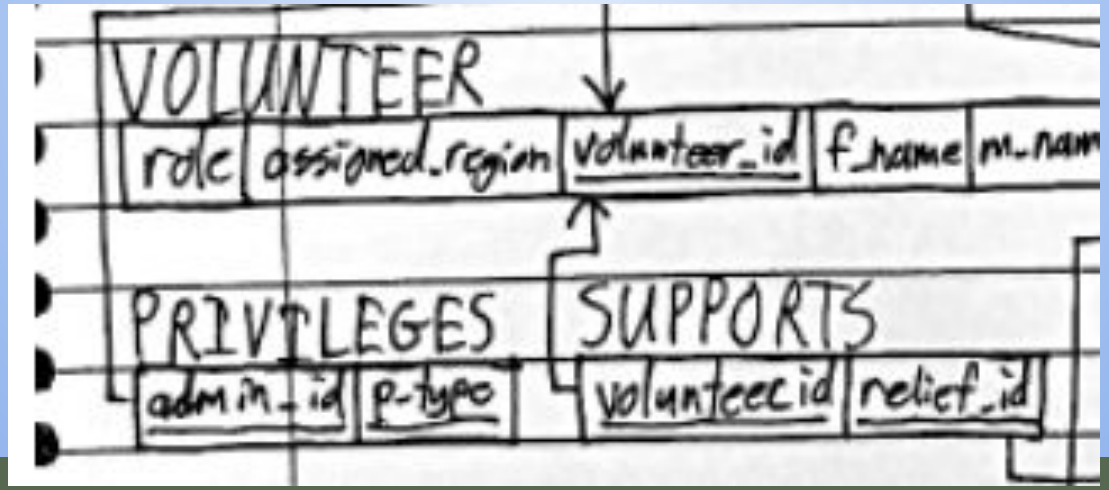
role - role of volunteer
assigned_region - region volunteer is assigned
volunteer_id - primary key
f_name, m_name, l_name - names

Privileges

admin_id - part of primary key
p_type - access to one privilege type, making it another part of the key

Supports

volunteer_id - part of primary key relative to volunteer
relief_id - part of primary key relative to relief



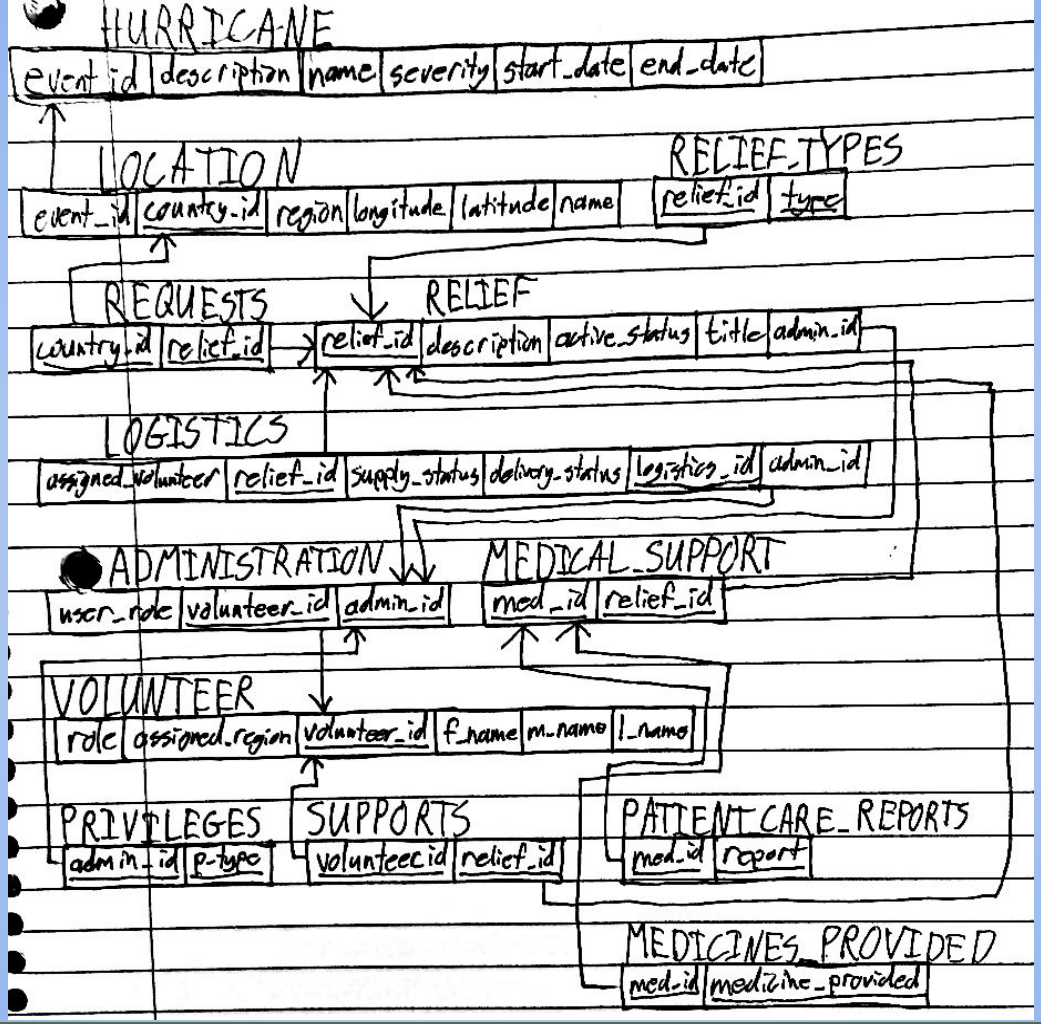
Relationals

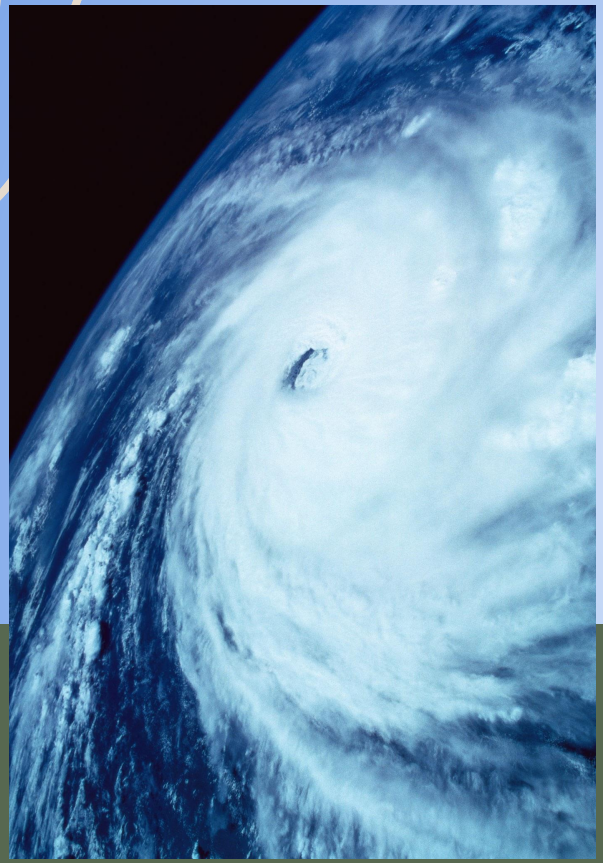
Patient Care Reports

med_id - part of primary key relative to medicines provided
report - other part of primary key - report type and details

Medicines Provided

med_id - part of primary key relative to medical support
medicine_provided - name of medicine provided and part of the key


HURRICANE
event_id
description
name
severity
start_date
end_date
LOCATION
event_id
country_id
region
longitude
latitude
name
RELIEF_TYPES
relief_id
type
REQUESTS
country_id
relief_id
RELIEF
relief_id
description
active_status
title
admin_id
LOGISTICS
assigned_volunteer
relief_id
supply_status
delivery_status
logistics_id
admin_id
ADMINISTRATION
user_role
volunteer_id
admin_id
MEDICAL_SUPPORT
med_id
relief_id
VOLUNTEER
role
assigned_region
volunteer_id
f_name
m_name
l_name
PRIVILEGES
admin_id
p-type
SUPPORTS
volunteer_id
relief_id
PATIENT_CARE_REPORTS
med_id
report
MEDICINES_PROVIDED
med_id
medicine_provided



04

MySQL and Testing Queries

1. **Hurricane Table**

Event_id	Name	Severity	description	Start_Date	End_Date	Duration
H001	A	4	Strong winds	6/01/24	6/05/24	4 days
H002	B	3	rainfall	7/10/24	7/13/24	3 days

2. **Location Table**

Country_id	Name	Region	Latitude	Longitude
C001	USA	Florida	27.6648	-81.5158
C002	MEXICO	Yucatan	20.6843	-88.5678

3. **Relief Table**

Relief_id	Title	Type	Active	Description
R001	Food Distribution	Food Aid	Active	Emergency Food Packages
R002	Medical Assistance	Medical Aid	Completed	Doctors and nurses providing aid

Data

- **Hurricane Table:** Contains details of hurricane events: ID, name, severity, description, start/end dates, and duration.
- **Location Table:** Lists geographic locations with country ID, name, region, latitude, and longitude.
- **Relief Table:** Tracks relief efforts with ID, title, type, active status, and description

4. Logistics Table

Logistics_id	Relief_id	Supply_Status	Delivery_Status
L001	R001	In Transit	Pending
L002	R002	Delivered	Completed

5. Medical Support Table

Med_id	Relief_id	Medicines_Provided	Patients_care_reports
M001	R001	Painkillers, Antibiotics	12 Reports

6. Volunteer Table

Volunteer_id	First_Name	Last_Name	Role	Assigned_Region	Total_Volunteers
V001	John	Doe	Field Vol	Florida	50
V002	Alice	Smith	Admin	Yucatan	30

7. Administration Table

Admin_id	User_Role	Privileges
A001	Manager	Full Access

Data

- **Logistics Table:** Tracks logistical operations with IDs, associated relief effort, supply status, and delivery status.
- **Medical Support Table:** Details medical support provided, including a medical ID, related relief effort, medicines provided, and patient care reports.
- **Volunteer Table:** Lists volunteers with their ID, first and last names, role, assigned region, and the total number of volunteers in their region.
- **Administration Table:** Contains records of administrative users with their ID, user role, and access privileges.

MySQL Database

CREATE

```sql
CREATE TABLE Hurricane (
    Event_id VARCHAR(10) PRIMARY KEY,
    Name VARCHAR(50),
    Severity INT,
    Description TEXT,
    Start_Date DATE,
    End_Date DATE,
    Duration VARCHAR(20)
);
```

RELATION

```sql
-- Hurricane Affects Country (1:M)
CREATE TABLE Hurricane_Affects (
    Event_id VARCHAR(10),
    Country_id VARCHAR(10),
    PRIMARY KEY (Event_id, Country_id),
    FOREIGN KEY (Event_id) REFERENCES Hurricane(Event_id),
    FOREIGN KEY (Country_id) REFERENCES Location(Country_id)
);
```

INSERT

```sql
INSERT INTO Hurricane VALUES
('H001', 'A', 4, 'Strong winds', '2024-06-01', '2024-06-05', '4 days'),
('H002', 'B', 3, 'Heavy rainfall', '2024-07-10', '2024-07-13', '3 days'),
('H003', 'C', 5, 'Catastrophic storm surge', '2024-08-20', '2024-08-25', '5 days');
```

Basic MySQL Queries

```sql
SELECT *
    FROM Logistics
    WHERE Delivery_Status = 'Ongoing';
```

Logistics_id	Relief_id	Supply_Status	Delivery_Status
L007	R007	Dispatched	Ongoing
L009	R009	In Transit	Ongoing

```sql
SELECT Name
    FROM Hurricane;
```

Name
A
B
C
Diana
Edward
Fiona
George
Helena
Isaac

```sql
SELECT
    r.Relief_id,
    r.Title,
    r.Type,
    r.Active,
    l.Delivery_Status

    FROM Relief r
    JOIN Logistics l ON r.Relief_id = l.Relief_id
    WHERE r.Active = 'Active';
```

Relief_id	Title	Type	Active	Delivery_Status
R001	Food Distribution	Food Aid	Active	Pending
R003	Shelter Setup	Housing	Active	Not Started
R007	Child Care Units	Welfare	Active	Ongoing

Advanced MySQL Queries

```sql
SELECT v.First_Name, v.Last_Name, r.Title
    FROM Volunteer v
    JOIN Volunteer_Relief vr ON v.Volunteer_id = vr.Volunteer_id
    JOIN Relief r ON vr.Relief_id = r.Relief_id
    WHERE r.Active = 'Active';
```

First_Name	Last_Name	Title
John	Doe	Food Distribution
Ricardo	Fernandez	Food Distribution
Mohammed	Khan	Food Distribution
Sarah	Lee	Shelter Setup
Mohammed	Khan	Shelter Setup
Omar	Hassan	Water Purification
Omar	Hassan	Child Care Units
Anna	Koenig	Child Care Units

```sql
SELECT l.Name AS Location,
    COUNT(r.Relief_id) AS Total_Relief_Requests,
    GROUP_CONCAT(r.Title SEPARATOR ', ') AS Relief_Titles
    FROM Location l
    JOIN Country_Requests_Relief cr ON l.Country_id = cr.Country_id
    JOIN Relief r ON cr.Relief_id = r.Relief_id
    GROUP BY l.Name;
```

Location	Total_Relief_Requests	Relief_Titles
Belize	2	Shelter Setup, Fuel Delivery
Cuba	1	Shelter Setup
Haiti	2	Medical Assistance, Rescue Ops
Honduras	3	Food Distribution, Communication Setup, Evacuation Transport
Jamaica	1	Fuel Delivery
Mexico	1	Medical Assistance
Puerto Rico	2	Water Purification, Child Care Units
USA	3	Food Distribution, Shelter Setup, Communication Setup

Advanced MySQL Queries

```
SELECT
    r.Title AS Relief_Title,
    r.Type,
    r.Active,
    l.Supply_Status,
    l.Delivery_Status,
    v.Assigned_Region,

    COUNT(v.Volunteer_id) AS Total_Volunteers
    FROM Relief r
    JOIN Logistics l ON r.Relief_id = l.Relief_id
    JOIN Volunteer v ON v.Assigned_Region IS NOT NULL
    GROUP BY r.Title, r.Type, r.Active, l.Supply_Status, l.Delivery_Status, v.Assigned_Region;
```

Relief_Title	Type	Active	Supply_Status	Delivery_Status	Assigned_Region	Total_Volunteers
Food Distribution	Food Aid	Active	In Transit	Pending	Florida	3
Medical Assistance	Medical Aid	Completed	Delivered	Completed	Florida	3
Shelter Setup	Housing	Active	Awaiting Dispatch	Not Started	Florida	3
Child Care Units	Welfare	Active	Dispatched	Ongoing	Florida	3
Communication Setup	Infrastructure	Ongoing	Awaiting	Not Started	Florida	3
Fuel Delivery	Energy Support	Pending	In Transit	Ongoing	Florida	3
Evacuation Transport	Transport	Completed	Delivered	Completed	Florida	3
Food Distribution	Food Aid	Active	In Transit	Pending	Yucatan	1
Medical Assistance	Medical Aid	Completed	Delivered	Completed	Yucatan	1
Shelter Setup	Housing	Active	Awaiting Dispatch	Not Started	Yucatan	1
Child Care Units	Welfare	Active	Dispatched	Ongoing	Yucatan	1
Communication Setup	Infrastructure	Ongoing	Awaiting	Not Started	Yucatan	1
Fuel Delivery	Energy Support	Pending	In Transit	Ongoing	Yucatan	1
Evacuation Transport	Transport	Completed	Delivered	Completed	Yucatan	1
Food Distribution	Food Aid	Active	In Transit	Pending	Havana	2
Medical Assistance	Medical Aid	Completed	Delivered	Completed	Havana	2
Shelter Setup	Housing	Active	Awaiting Dispatch	Not Started	Havana	2
Child Care Units	Welfare	Active	Dispatched	Ongoing	Havana	2
Communication Setup	Infrastructure	Ongoing	Awaiting	Not Started	Havana	2
Fuel Delivery	Energy Support	Pending	In Transit	Ongoing	Havana	2
Evacuation Transport	Transport	Completed	Delivered	Completed	Havana	2

Conclusion

- The Storm Guard Disaster Relief Coordination System project modernized disaster relief efforts by replacing Excel-based processes with a scalable, centralized SQL database.
- The team, including database engineering, UI/UX development, and integration testing, collaborated to model and implement a relational schema that supports real-time, role-based data access and advanced querying capabilities.
- The project highlighted the importance of clearly defined user roles and the need for security.
- The system's potential expansion includes a responsive web or mobile interface, hosting on cloud platforms, and incorporating machine learning for supply needs prediction.

THANKS

Do you have any questions?