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UPHAND: A SMART DISASTER RELIEF COORDINATION PLATFORM

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Abstract:
Disaster situations such as floods, earthquakes, fires, landslides, cyclones, and accidents create significant challenges in emergency communication, rescue operations, volunteer coordination, and resource management. Traditional disaster response approaches often depend on manual communication and separate systems, which can result in delayed assistance, poor coordination, and limited monitoring of emergency activities. This paper presents Uphand, a smart web-based Disaster Relief Coordination Platform designed to improve emergency response and volunteer management through centralized digital coordination.
The proposed platform enables administrators to create and manage disaster events, affected users to submit emergency help requests, and volunteers to identify and respond to nearby requests. The system incorporates live location tracking using latitude and longitude, secure authentication, OTP-based email verification, centralized disaster monitoring, and notification generation. The platform is implemented using HTML5, CSS3, JavaScript, Bootstrap, jQuery, Node.js, Express.js, PostgreSQL, Sequelize ORM, JWT authentication, bcrypt, and Nodemailer. Docker and GitHub are used for deployment and version control.
The proposed system integrates disaster management, emergency request handling, volunteer coordination, location-based assistance, and centralized monitoring into a single platform. The system is intended to reduce communication delays, improve volunteer coordination, support location-based rescue activities, and provide a more organized approach to disaster management.
Keywords: Disaster Management, Emergency Response, Volunteer Coordination, Live Location Tracking, Disaster Relief, Web Application, Emergency Communication, Centralized Monitoring

1. Introduction

Natural and man-made disasters can occur with little warning and may cause significant damage to people, infrastructure, and resources. Floods, earthquakes, fires, landslides, cyclones, and accidents require rapid communication and coordinated response between affected citizens, volunteers, rescue teams, and authorities. In such situations, delays in communication and inefficient resource coordination can increase the difficulty of rescue and relief operations.

The project report identifies that conventional disaster response systems often depend on manual communication and emergency helpline services. Such approaches may not provide centralized volunteer coordination, live location tracking, or comprehensive disaster monitoring.

To address these challenges, **Uphand: Disaster Relief Coordination Platform** is proposed as a centralized web-based system. The platform allows administrators to create disaster events, affected users to raise emergency requests, and volunteers to provide assistance based on nearby locations. It combines emergency request management, volunteer coordination, authentication, location tracking, and centralized monitoring within one system.

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The primary aim of Uphand is to improve emergency response, disaster communication, and volunteer management using modern web technologies. The project objectives include secure registration and login, OTP-based email verification, disaster management, emergency request handling, exact location capture, volunteer coordination, centralized monitoring, and improved rescue response.

1.1 Problem Statement

During disaster situations, affected people may face difficulties in contacting rescue teams or volunteers. Existing approaches may rely on manual communication and separate channels, resulting in:

- Delayed emergency response
- Difficulty identifying nearby help requests
- Lack of centralized volunteer coordination
- Limited monitoring by authorities
- Inefficient emergency communication
- Lack of live location-based support

Therefore, a centralized platform is required to connect affected users, volunteers, and administrators while supporting real-time location-based emergency assistance.

1.2 Objectives

The major objectives of the proposed platform are:

1. To provide secure user registration and login.
2. To implement OTP-based email verification.
3. To allow administrators to create and manage disaster events.
4. To enable affected users to raise emergency help requests.
5. To capture user location using latitude and longitude.
6. To coordinate volunteers during disaster situations.
7. To improve communication and rescue response time.
8. To provide centralized disaster monitoring.

2. RELATED WORK AND LITERATURE REVIEW

Disaster management systems have been developed using different approaches, including government alert systems, emergency communication applications, NGO volunteer management systems, crisis mapping, crowdsourcing, and manual rescue coordination. The literature survey conducted for the project indicates that existing systems provide useful emergency communication capabilities but often lack integrated volunteer coordination and location-based rescue support.

Review in broader aspect is as followed :

1. **Limited integration of disaster response activities**: Altay and Green [1] reviewed disaster operations management research, highlighting the need for effective and timely operational solutions. Uphand addresses this by integrating disaster management, emergency requests, and volunteer coordination into one platform.

2. Limited coordination beyond emergency alerts: Hughes and Palen [2] examined social media use during emergencies. Uphand focuses on connecting emergency requests with volunteer assistance rather than relying solely on information broadcasting.

3. Communication gaps between response organizations: Kapucu [3] examined interagency communication and coordination during emergencies. Uphand provides a centralized platform for communication and monitoring among users, volunteers, and administrators.

4. Challenges in humanitarian resource coordination: Van Wassenhove [4] discussed the complexity of humanitarian supply chains. Uphand supports volunteer coordination, while advanced relief inventory and resource optimization remain future enhancements.

5. **Challenges in organizing digital volunteers**: The study by Xiang and colleagues [5] examines the types, roles, advantages, and challenges of digital volunteering during emergencies. Uphand provides a structured volunteer module connected to emergency requests.

6. **Effective use of geographical information**: Tzavella and Skopeliti [6] reviewed volunteered geographic information in crisis and disaster management. Uphand uses latitude and longitude to support location-based emergency assistance.

7**. Limitations of social media-based emergency information**: Reuter and Kaufhold [7] reviewed the use of social media in emergencies. Uphand provides a dedicated platform for managing emergency requests instead of depending on fragmented social media communication.

8. **Organizational challenges in crisis mapping**: Hunt and Specht [8] examined collaboration and organizational structures in crowdsourced mapping. Uphand combines location-based information with volunteer coordination and administrative monitoring.

9**. Trust in digital volunteer participation**: Ruohonen and Backholm [9] investigated the inclusion of digital volunteers in crisis management. Uphand incorporates authentication and defined user roles to support structured participation.

10. **Need for structured digital volunteer workflows**: Park and Johnston [10] proposed a framework for analyzing digital volunteer contributions. Uphand establishes a defined workflow from emergency request submission to volunteer assistance.

11. **Disaster logistics knowledge management**: Tatham and Spens [11] proposed a knowledge-management approach for humanitarian logistics. Uphand centralizes disaster and request information, although advanced logistics knowledge-management functions are outside its current scope.

12. **Real-time information and situational awareness**: Vieweg and colleagues [12] studied microblogging during natural hazards. Uphand captures emergency request details and geographical information to support response coordination.

13. **Need for organized collaboration in disaster mapping**: Hunt and Specht [8] also highlight organizational considerations in crowdsourced mapping. Uphand aims to connect location-based requests with defined volunteer and administrator workflows rather than treating mapping as a standalone activity.

2.1 Existing Disaster Management Systems

Existing disaster response approaches can broadly be classified into:

- Government disaster alert systems
- Emergency communication applications
- NGO-based volunteer management systems
- Manual rescue coordination systems
- Crisis mapping and crowdsourcing systems

These systems can support individual aspects of disaster response, but integrated coordination among affected users, volunteers, and administrators remains a challenge according to the project literature survey.

2.2 Research Gap

The project identifies several gaps in existing disaster management as already discussed in the section 2 will be seen and covered by our platform like :

• Lack of centralized disaster communication

• Limited volunteer coordination

• Delayed emergency response
• Lack of live location tracking
• Limited monitoring and analytics
• Fragmented communication between stakeholders

The identified gap motivates the development of Uphand as an integrated platform combining disaster management, emergency requests, volunteer coordination, location tracking, and centralized monitoring.

2.3 Comparative Analysis

Feature	**Conventional/Existing Approaches**	**Proposed Uphand**
Disaster Management	Limited/Separate	Centralized
Emergency Requests	Often manual	Digital request handling
Volunteer Coordination	Limited	Integrated volunteer module
Location Support	Limited	GPS/location-based support
Authentication	Varies	Secure authentication
Monitoring	Limited	Centralized dashboard
Communication	Fragmented	Centralized platform
Scalability	Depends on system	Designed as scalable web platform

3. PROPOSED SYSTEM

Uphand is a web-based disaster relief coordination platform consisting of multiple interconnected modules. The platform connects three primary actors: **users, volunteers, and administrators**.

Affected users can register, authenticate themselves, and submit emergency requests. The system captures their location and stores the request in the database. Volunteers can view nearby emergency requests and provide assistance. Administrators can create disaster events and monitor system activities through centralized management facilities.

3.1 System Workflow

The overall workflow is:

1. User registers or logs into the platform.
2. User verifies the email using OTP.
3. Administrator creates a disaster event.
4. Affected user raises an emergency request.
5. The system captures the user's location.
6. Emergency request is stored in the database.
7. Volunteers view available/nearby requests.
8. Volunteer provides assistance.
9. Administrator monitors activities.
10. Notifications and reports can be generated.

4. SYSTEM ARCHITECTURE AND METHODOLOGY

The proposed system follows a layered web-based architecture consisting of:

- Frontend web application
- Backend processing server
- Authentication module
- Disaster management module
- Volunteer coordination module
- Database layer
- Analytics/monitoring dashboard

The frontend manages user interaction, while the backend processes requests and disaster-related operations. PostgreSQL is used to store user, disaster, and emergency request information.

4.1 User Module

The User Module provides:

- Registration
- Login
- OTP verification
- Emergency request creation
- Location sharing

It allows affected citizens to communicate their emergency requirements through the platform.

4.2 Admin Module

The Admin Module provides centralized control over disaster activities. Administrators can:

- Create disaster events
- Manage disaster information
- Monitor emergency requests
- Monitor system activities
- Use the centralized monitoring dashboard

4.3 Volunteer Module

The Volunteer Module supports volunteer coordination. Volunteers can view emergency requests, particularly requests associated with nearby locations, and provide support during disaster situations.

4.4 Authentication Module

The system uses secure authentication mechanisms. JWT authentication is used for user authentication, bcrypt is used for password security, and Nodemailer supports email-related functionality. OTP-based email verification is also included.

4.5 Location Tracking

Location tracking is an important component of the platform. User latitude and longitude are captured to support location-based emergency assistance. This enables volunteers to identify requests according to geographical proximity.

4.6 Database Layer

PostgreSQL is used as the primary database, with Sequelize ORM supporting database interaction.

The database stores user, disaster, and emergency request information securely.

5. IMPLEMENTATION DETAILS

The Uphand Disaster Relief Coordination Platform is implemented as a web-based system that connects users, volunteers, and administrators through a centralized disaster management platform. The implementation includes user registration and login, OTP-based email verification, disaster creation and management, emergency request handling, live location tracking, volunteer coordination, and centralized monitoring.

The frontend is developed using HTML5, CSS3, JavaScript, Bootstrap, and jQuery. The backend is developed using Node.js and Express.js. PostgreSQL is used for database management with Sequelize ORM for database interaction. JWT authentication and bcrypt are used for authentication and security, while Nodemailer is used for email-related functionality. Docker and GitHub are used for deployment and version control.

The implementation is divided into different modules including the User Module, Admin Module, Volunteer Module, Authentication Module, and Database Module. The User Module manages registration, login, and emergency request creation. The Admin Module manages disaster creation and monitoring. The Volunteer Module supports volunteer coordination and rescue activities. The Authentication Module manages JWT authentication and OTP verification, while the Database Module securely stores disaster and user information.

5.1 End-to-End Pipeline Flow

The end-to-end flow of the Uphand platform begins with user registration and login. After registration, the user's email is verified using an OTP-based verification mechanism. The administrator can then create and manage disaster events through the system.

When an affected user requires assistance, the user raises an emergency request through the platform. The system captures the user's live location using latitude and longitude and stores the disaster and emergency-request information in the database.

The stored request can then be viewed by volunteers. Volunteers can identify nearby emergency requests and provide the required assistance. Administrators monitor disaster activities and emergency requests through the centralized monitoring system.

The complete flow implemented in the project is:

User Registration/Login → OTP Email Verification → Admin Creates Disaster → User Raises Emergency Request → Capture User Location → Store Request in Database → Volunteer Views Request → Volunteer Provides Support → Admin Monitors Activities.

5.2 Docker Service Topology

Docker is included in the project as part of the deployment technology stack. It is used to support deployment of the web-based disaster management platform. GitHub is used for version control.

The project report does not specify individual Docker services, container ports, Docker Compose configuration, or a detailed Docker service topology. Therefore, such service-level details are not added here.

The software components specified in the project include Node.js, PostgreSQL, Express.js, Visual Studio Code, Docker, GitHub, and a web browser.

5.3 Data and Experiment Flow

The data flow in the Uphand platform involves users, volunteers, administrators, the backend server, and the database.

Users interact with the system through the frontend application. User authentication, disaster creation, emergency-request handling, volunteer coordination, and monitoring operations are processed through the backend server. PostgreSQL stores user, disaster, and emergency-request information.

The major data flow consists of:

Users/Volunteers/Admin → Frontend Web Application → Backend Processing Server → PostgreSQL Database

The system also uses the captured latitude and longitude information associated with emergency requests to support location-based assistance. The Data Flow Diagram described in the project includes Users, Volunteers, Admin, Database, and Backend Server, with processes such as user authentication, disaster creation, request handling, volunteer coordination, and monitoring and analytics.

The project report does not describe machine-learning experiments or experiment-tracking systems. Therefore, no experimental workflow is claimed beyond the implemented system flow.

5.4 Orchestration

The Uphand project does not specify an orchestration framework such as Apache Airflow, Kubernetes, or similar workflow-orchestration tools. Therefore, orchestration-specific implementation details are not claimed.

The project instead describes a sequence of application operations in which user requests are processed by the backend, stored in PostgreSQL, made available for volunteer coordination, and monitored by administrators. The system also includes Docker for deployment.

6. Dataset

The Uphand project does not use a machine-learning dataset for model training or evaluation. It is a web-based disaster management and volunteer coordination platform.

The system manages application data including:

- User information
- Disaster information
- Emergency requests
- User location information
- Volunteer-related information
- Authentication information

PostgreSQL is used to store disaster, user, and request information securely.

The project report does not provide a numerical dataset size or a separate experimental dataset. Therefore, no dataset size or statistical dataset description is added.

6.1 Adaptive Pipeline Behaviour

The Uphand project does not contain an adaptive machine-learning pipeline like the AgroIntel project. Therefore, adaptive preprocessing, adaptive feature selection, or model-selection behaviour is not applicable to the current system.

Instead, the platform follows a predefined disaster-management workflow. Users register and verify their accounts, administrators create disaster events, affected users raise emergency requests, the system captures their location, volunteers view requests, and administrators monitor activities.

The main system behaviour is based on real-time emergency coordination and location-based support rather than adaptive machine-learning processing.

6.2 Model Performance

The Uphand project does not implement a machine-learning prediction model and therefore does not have model-performance metrics such as accuracy, precision, recall, MAE, RMSE, or R^2.

The primary focus of the system is disaster coordination, emergency request handling, volunteer management, location tracking, and centralized monitoring.

The project report identifies the expected system outcomes as:

- Faster disaster response

- Better emergency communication
- Efficient volunteer coordination
- Improved disaster monitoring
- Reduced rescue delays
- Better resource management

For a future research publication, actual system-performance measurements can be added if testing data is available.

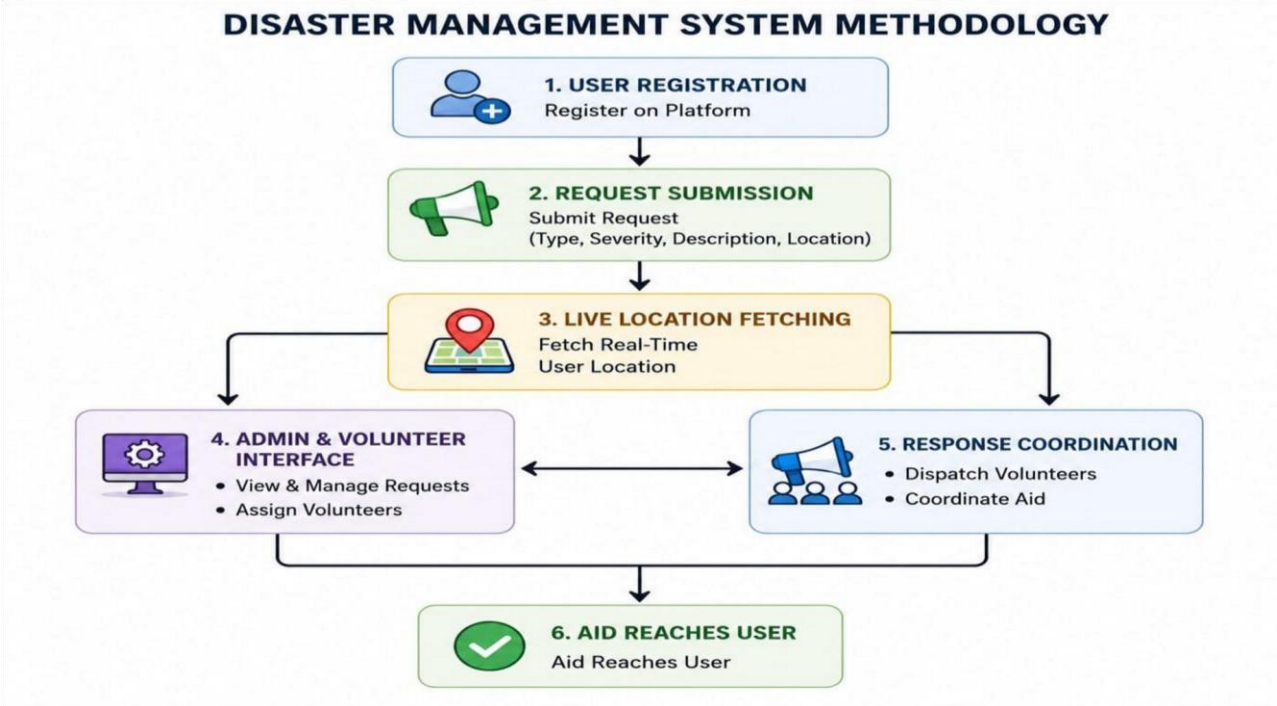
6.3 Discussion

The proposed Uphand platform addresses the coordination problems identified in the literature survey. Existing disaster management approaches described in the project report mainly focus on emergency alerts, communication, or manual rescue coordination, while limited attention is given to integrated volunteer coordination and location-based rescue support.

The proposed platform combines disaster management, emergency request handling, volunteer coordination, emergency tracking, and centralized monitoring into a single system. This integration can help reduce communication gaps between affected citizens, volunteers, and administrators.

Live location tracking is an important component because it enables emergency requests to contain latitude and longitude information, allowing volunteers to identify nearby requests. The centralized monitoring facility also enables administrators to manage disaster activities and requests from one platform.

However, the current project should be evaluated using real-world or simulated emergency scenarios before making quantitative claims about response-time improvement or system performance.



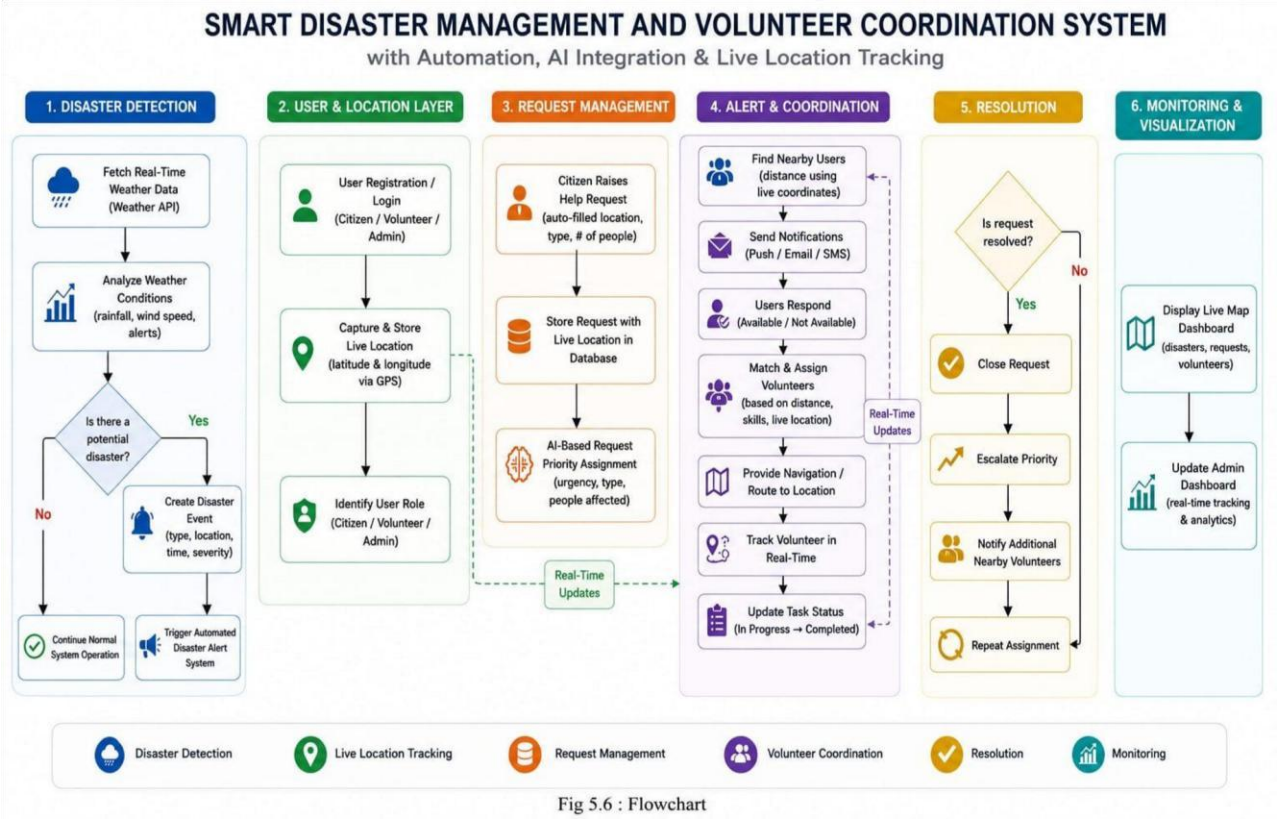
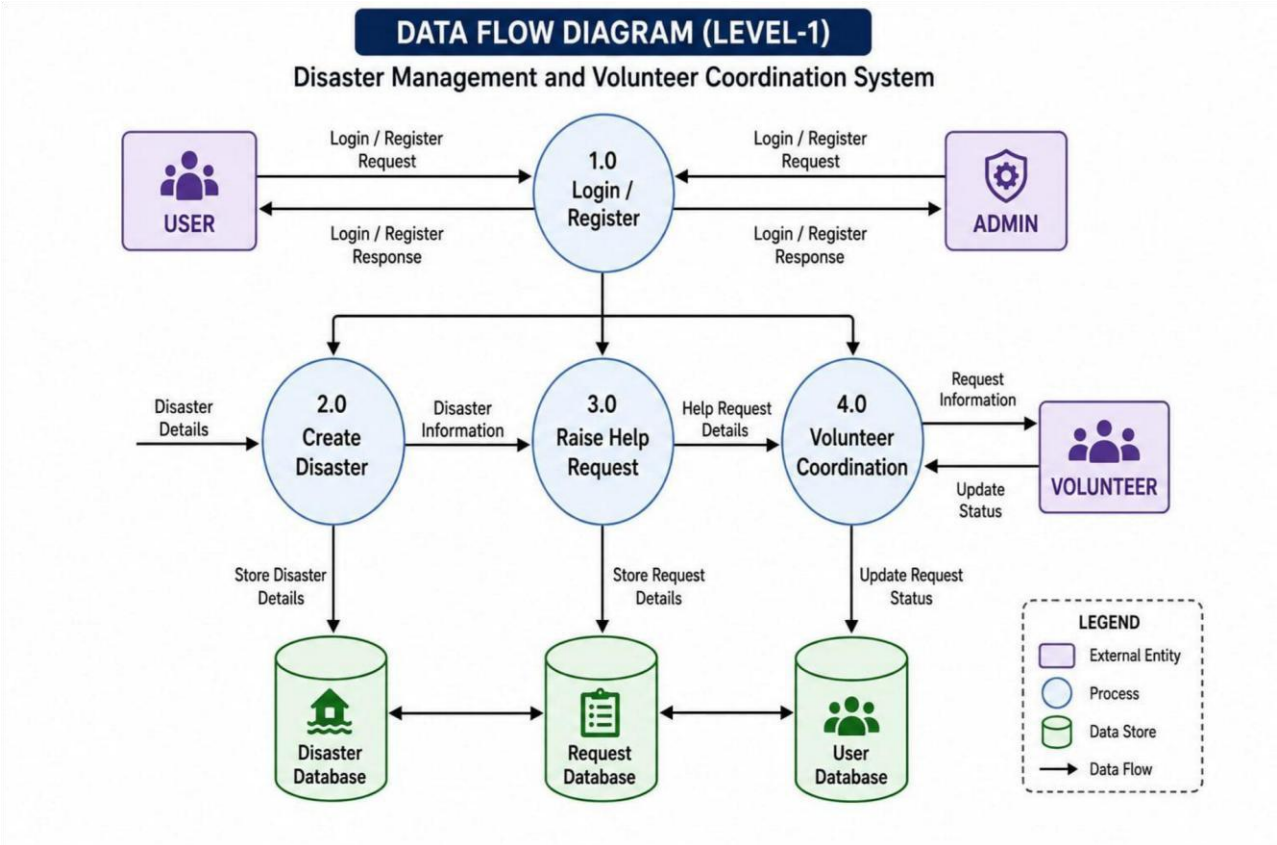


Fig 5.6 : Flowchart



6.4. COMPARISON WITH EXISTING APPROACHES

The literature survey identifies that existing disaster management approaches include government disaster alert systems, emergency communication applications, NGO volunteer management systems, and manual rescue coordination systems. These approaches provide useful disasterresponse functions but have limited real-time coordination and monitoring capabilities.

The proposed Uphand platform differs by integrating several functions into a single web-based system.

The existing approaches identified in the project have limitations such as:

- Limited volunteer coordination
- Manual communication methods
- Lack of location-based request handling
- No centralized disaster dashboard

The proposed platform provides:

- Real-time disaster coordination
- Volunteer management
- GPS-based emergency tracking
- Secure authentication
- Centralized monitoring dashboard

Thus, Uphand focuses on integrating affected users, volunteers, and administrators rather than providing only an alert or communication service.

7. LIMITATIONS

The current Uphand platform has several limitations that should be considered.

- **Manual dependency:** The effectiveness of the platform depends on users submitting accurate emergency requests and volunteers responding to them.
- **Network dependency:** Internet access is required for users and volunteers to communicate with the platform.
- **Server downtime:** Server failures can temporarily affect access to disaster-management services.
- **Data loss:** Loss of stored information may affect disaster and emergency-request management.
- **Security vulnerabilities:** As an online platform, security threats need to be continuously addressed.
- **Network issues:** Poor network connectivity may affect communication and location sharing.
- **Incorrect location information:** Incorrect or unavailable location information may affect location-based assistance.

The current project also does not include AI-based disaster prediction, automated emergency notifications, weather API integration, mobile application support, advanced live analytics, or a realtime chat system. These are identified as future enhancements in the project report.

These enhancements can further improve the intelligence, accessibility, communication, and scalability of the disaster management platform.

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