

Chapter 2

The Emergency Response Decision Support System Framework

An emergency response decision support system (ERDSS) needs to assist decision makers to evaluate emergency plans and select an appropriate plan of action during an emergency by supporting heterogeneous emergency response data sources and providing decision makers with access to appropriate emergency rescue knowledge. It also needs to provide differentiated services to meet particular requirements. This chapter describes the ERDSS framework and its main components in detail.

2.1 The ERDSS Framework

We propose an ERDSS framework that consists of ten functional modules: Emergency Service Helpdesk, Command and Coordination Center, Emergency Plan Management, Emergency Relief Supplies Management, Emergency Finance Budget Management, Emergency Organization and Activity Management, Emergency Knowledge Warehouse, Emergency Alarm Management, and Problem Analysis and Management. The ERDSS framework shown in Fig. 2.1 describes the main components of the system and their relationships.

For example, the scope of ontology modeling in flood emergency databases is based strictly on the principle of the smallest ontology agreement, and knowledge about the relationship between flood and flood emergency rescue is expressed through ontology. Flood rescue ontology consists of two parts; flood description and rescue plan description. The two parts include different levels of ontological concepts and form the hierarchy of the flood ontology description system.

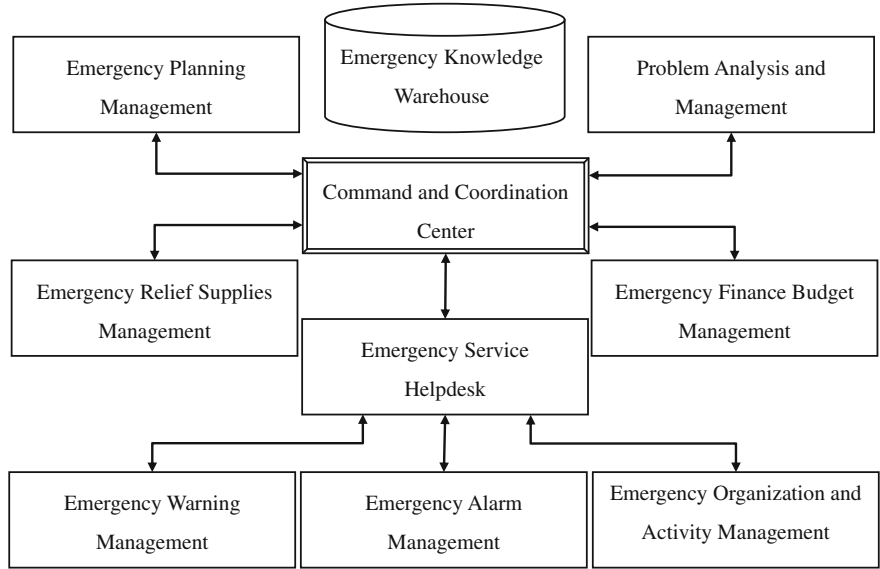


Fig. 2.1 The ERDSS Framework

2.2 The Emergency Service Helpdesk Module

Decision making in emergency response is an extremely time-sensitive and challenging task that requires immediate and effective response from decision makers who are surrounded by a variety of uncertain information and are under huge pressure from the need to coordinate action (Green and Kolesar 2004). The Service Desk is a key tool to collect, share and disseminate communications and emergency information efficiently and undertake preliminary analysis. These roles are important in helping decision makers make timely and effective decisions during emergency response. However, Service Desk is not an easy role, because it deals with diversified external information and coordinates various organizations.

During emergency response, the ERDSS will receive a large number of requests for timely information screening and processing. Therefore, the ERDSS interface needs to integrate multiple data sources and communication channels at a simple, single contact point that collects emergency information from the public and maintains good communications with the public and external organizations. The Service Helpdesk, a module that connects public emergency information sources and other modules such as the Command and Coordination Module, is the only information interface in ERDSS that collects, analyzes, and releases emergency information. The module processes existing public emergency information and provides formal emergency response progress reports to the public. It also communicates with other emergency organizations.

The Emergency Service Helpdesk Module provides the following services:

1. Acts as a window for contact information collection and distribution;
2. Provides preliminary emergency data processing including analysis, normalization, and filtering;
3. Acts as the sole communication channel with other organizations;
4. Acts as the sole emergency information interface with other modules; and
5. Keeps the system scalable and flexible.

The Emergency Service Helpdesk Module corresponds to Service Desk in the Information Technology Infrastructure Library (ITIL). The module’s architecture is shown in Fig. 2.2.

The Emergency Service Helpdesk Module (see Fig. 2.2) has three components: the Distributed Heterogeneous Contact Information Interface, Preprocessor, and the Unified Data Interface. The Distributed Heterogeneous Contact Information Interface is an entry point collecting data about emergencies from the public, a window releasing emergency reports to the public, and a channel communicating with other organizations.

Preprocessor functions are preliminary analysis, information classification and normalization, communication process design, and feedback integration. The

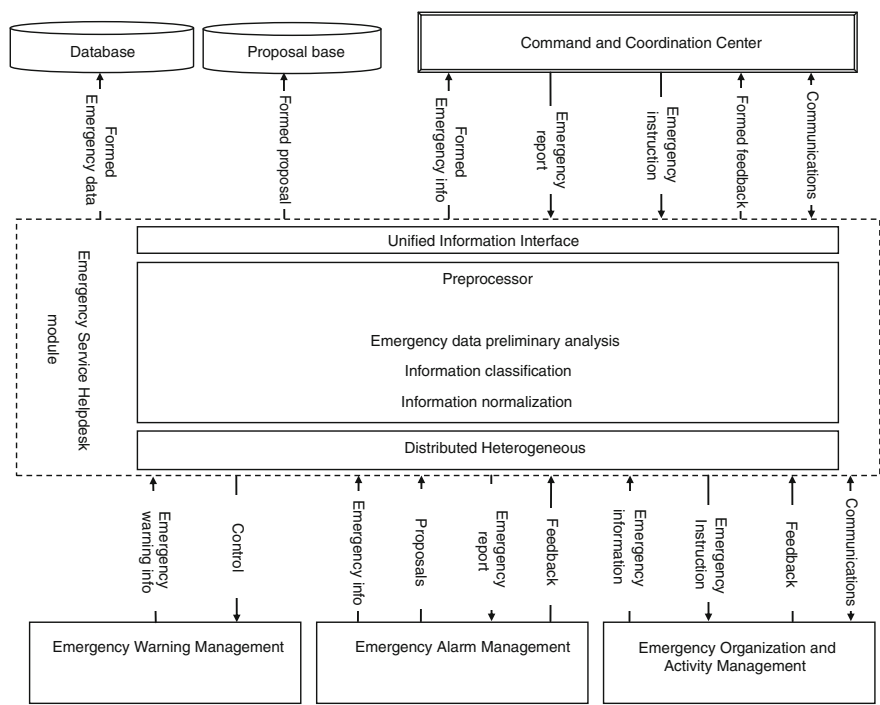


Fig. 2.2 Architecture of the emergency service helpdesk module

Unified Data Interface is an easy-to-use programming interface that offers formatted information and allows other modules to convert and exchange the data they need.

It is reasonable in government emergency response decision-making to use blog resources to help build a demand-oriented self-adaptive evaluation model. The subject is the information demand unit of emergency response decision-making, and the priority influence factor is the demand tendency of decision-making for information.

2.3 The Command and Coordination Center Module

Decision makers face three main challenges: how to propose reasonable emergency rescue plans, how to issue clear emergency commands, and how to coordinate the various organizations involved in emergency responses. “Command” refers to the way decision-makers organize and lead emergency responses. “Coordination” means correctly handling various internal and external relations among emergency organizations and promoting the goals of emergency rescue by creating favorable conditions for emergency rescue.

From the perspective of management, emergency coordination is a managerial function that organizes and coordinates different rescue activities during emergency response. Command and coordination are challenging because they involve multiple organizations and deal with uncertain and time-sensitive information.

An ERDSS needs to integrate emergency decision-making measures and coordinate multiple organizational objectives to identify the severity of an emergency, select and implement appropriate plans, make adjustments according to the actual situation, and monitor the results after response plans are implemented.

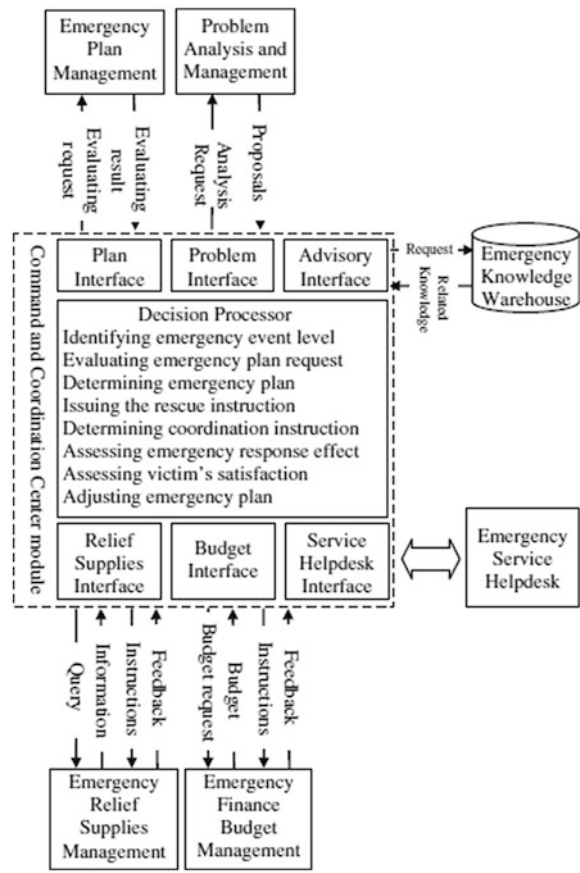
Therefore, the Command and Coordination module, located at the core of an ERDSS, is required to work as a command center to issue emergency instructions and as a coordination center to enable emergency organizations to work together to achieve shared rescue goals.

The Command and Coordination Center Module primarily handles existing emergency work. It may also run analyses to identify the causes of an emergency so that similar disasters do not reoccur.

The Command and Coordination Center Module provides the following services:

1. Identifies and confirms the severity of an emergency;
2. Monitors the entire emergency response process;
3. Makes emergency response decisions;
4. Coordinates multiple organizations to conduct rescue work;
5. Assesses the level of victims’ satisfaction; and
6. Modifies timely rescue measures.

Fig. 2.3 Architecture of the command and coordination center module



The Command and Coordination Center Module corresponds to the processes of Incident Management, Service Level Management, and IT Service Continuity Management in ITIL. The model's architecture is shown in Fig. 2.3.

The Command and Coordination Center Module (see Fig. 2.3) has seven components: Plan Interface, Advisory Interface, Problem Interface, Decision Processor, Relief Supplies Interface, Service Helpdesk Interface, and Budget Interface. Plan Interface's functions are evaluating the entry of emergency plans, submitting rescue plans for assessment, and receiving assessment results. Advisory Interface is a knowledge base that emergency decision makers can access which allows them to obtain emergency response knowledge such as contingency plans, emergency laws, emergency response rules, typical cases, emergency expert information, and other related knowledge. Problem Interface undertakes in-depth analysis to identify the causes of emergencies and measures to deal with them. Decision Processor identifies the scale of emergencies, determines which emergency plan should be chosen; issues rescue instructions, coordinates rescue operations, and assesses emergency response results. Relief Supplies Interface offers relief supplies, information, and feedback.

Service Helpdesk Interface handles information from the Emergency Service Helpdesk Module. Budget Interface is a channel for finance budget requests channel and handles applications for emergency relief funds.

Based on the analysis of the User Generated Content (UGC) characteristics of urban disasters, we are able to design a UGC-based urban disaster loss assessment index, build a dynamic and continuous monitoring and analysis algorithm for disaster, and study the disaster loss incremental assessment process to support disaster emergency response decisions.

2.4 The Emergency Plan Management Module

The importance of emergency plans is obvious when an emergency occurs that requires efficient emergency procedures (Ingram 2010). An emergency plan is a group of procedures that are implemented during an emergency that involves communication, planning, action, risk analysis, operational support, logistic support, and whatever is necessary to reduce impacts (Calixto and Larouvere 2010). Emergency plans seek the most efficient way to use necessary resources to meet urgent needs under conditions of emergency (Alexander 2005).

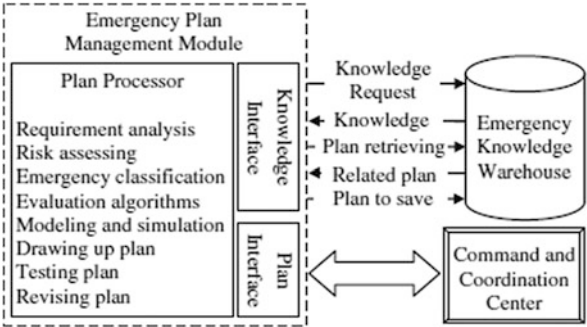
Emergency plans are major challenges for governments in many countries because there are different opinions about the appropriate emergency framework (Calixto and Larouvere 2010). Although every emergency is unique, they share the same response process: forecasting, making predictions, issuing warnings, predicting consequences, and developing plans. An emergency plan should consider an emergency from multiple angles. The ability of an emergency plan to deal with an emergency depends on its completeness, operability, effectiveness, flexibility, rapidity, and rationality (Cheng and Qian 2010). Alexander (2005) proposed 18 principles to judge the quality of an emergency plan and presented a standard for local government emergency plans.

The development and management of an emergency plan relies on a research center to study emergency requirements and risk, a development center to draw up and test the emergency plan, and a supervision component to supervise the plan's use and revision. The Emergency Plan Management Module located at the core of the ERDSS meets these requirements.

The Emergency Plan Management Module provides the following services:

1. Runs emergency requirements analysis and risk assessment;
2. Supports emergency classification;
3. Maintains the algorithms for evaluating emergency plan effectiveness;
4. Supports emergency plan modeling;
5. Simulates the environment through optimization analysis;
6. Supports drawing up and testing emergency plans; and
7. Supports supervision of the use and revision of emergency plans.

Fig. 2.4 Architecture of the emergency plan management module



The Emergency Plan Management Module corresponds to Service Level Management, IT Service Continuity Management, Capacity Management, and Availability Management processes in ITIL. The model’s architecture is shown in Fig. 2.4.

The Emergency Plan Management Module (see Fig. 2.4) has three components: Plan Interface, Knowledge Interface, and Plan Processor. Plan Interface handles the interactive information between this module and the Command and Coordination Center Module. Knowledge Interface is a channel retrieving and using emergency knowledge such as cases, rules, laws and regulations, data, models, and related emergency plans. Plan Processor functions include analyzing emergency requirements, assessing emergency risk, classifying emergency events according to severity and scope of impact, evaluating emergency plans according to the evaluation index system and algorithms, modeling emergency plans and simulation analysis, drawing up and testing specified emergency plans, releasing emergency plans stored in the knowledge warehouse, and revising outdated or defective plans.

In the case of the “7.21” heavy rainstorm in Beijing, the first action taken was to collect all relevant disaster data and extract the time parameters needed for the model. Second, macro and micro diagnostic analysis and evaluation were carried out in accordance with the model evaluation system. Third, CPN (CCSDS Principle Net) simulation tools were used for simulation experiments. Finally, policy recommendations were made based on the results of performance analysis and simulation results.

2.5 The Emergency Relief Supplies Management Module

Relief Supplies Management is a type of emergency response and of social management. It serves broad social objectives rather than the benefit of an individual organization. Relief supplies operations rely heavily on logistics under uncertain, risky, and urgent situations. Therefore, supply chain management principles are applied in a different way from their application in traditional businesses.

Coordination, vehicle routing, and supply allocation decisions are critically important for relief supplies operations.

To deliver the right relief supplies in a timely manner to the right locations, an ERDSS relies on a research center to study relief supplies requirements and optimize routes, a schedule center to coordinate transportation in the relief supply chains, and a measurement point to obtain feedback and undertake victims' satisfaction analysis. The Emergency Relief Supplies Management Module is located at the core of an ERDSS.

The Emergency Relief Supplies Management Module provides the following services:

- 1. Determines categories and quantities of relief supplies;
- 2. Provides routing algorithms, modeling, and simulation;
- 3. Provides logistics operation and coordination;
- 4. Manages relief supplies distribution;
- 5. Collects relief supplies feedback and undertakes victims' satisfaction analysis; and
- 6. Provides instructions on how to execute emergency rescues.

The Emergency Relief Supplies Management Module corresponds to Service Level Management and Capacity Management Processes in ITIL. The model's architecture is shown in Fig. 2.5.

The Emergency Relief Supplies Management Module (see Fig. 2.5) has three components: Relief Supplies Interface, Knowledge Interface, and Relief Supplies Processor. Relief Supplies Interface handles the interactive information about relief supplies between this module and the Command and Coordination Center Module. Knowledge Interface is a channel to retrieve and use emergency knowledge related to relief supplies. Relief Supplies processor functions are determining categories and quantities of emergency relief supplies, providing inventory management and

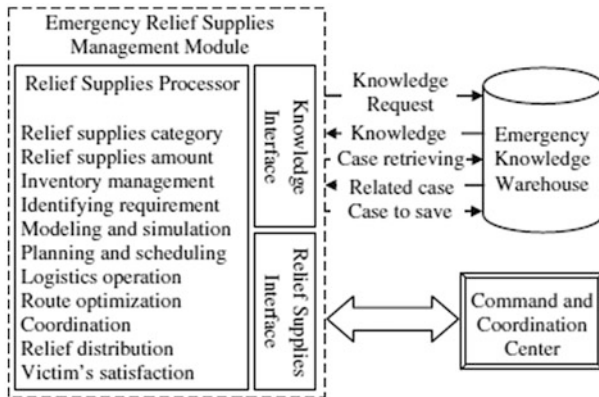


Fig. 2.5 Architecture of the emergency relief supplies management module

statistics reports, identifying relief supplies requirements, optimizing routes, modeling and simulation, coordinating relief supplies logistics, distributing relief supplies, and running victims' satisfaction analysis.

In the case of the "7.21" heavy rainstorm in Beijing, it was necessary to combine the emergency plan for an urban natural disaster and the plan for rational use of the emergency materials reserves, and to establish a unified material management platform based on GIS. The platform interacts seamlessly with the rescue decision support platform. Further, it achieves unified scheduling of emergency supplies management in the event of natural disasters.

2.6 The Emergency Finance Budget Management Module

The cost of emergency response is enormous. The more severe an emergency, the greater the emergency response costs. Emergency relief activities consume a significant amount of labor, materials, and financial resources. Costs must be monitored to ensure the quality of emergency rescue. Barfod et al. proposed a concept of composite decision support for complex decisions that combines cost-benefit analysis, multi-criteria decision analysis for economic assessment, and strategic impact assessment (Barfod et al. 2011).

To balance rescue costs and the rescue effect, an ERDSS needs a budget center to provide sufficient funds for emergency operations according to emergency plans, an accounting center to monitor the cost of emergency activities, and a finance report center to analyze and evaluate the effect of emergency activities from a cost perspective. The Emergency Finance Budget Management Module located at the core of an ERDSS meets these requirements.

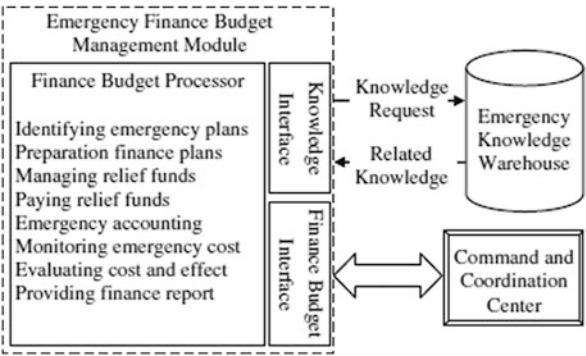
The Emergency Finance Budget Management Module provides the following services:

1. Provides financial plans consistent with emergency plans;
2. Provides emergency accounting;
3. Monitors the cost of emergency activities;
4. Supports budget models and provides emergency cost prediction algorithms;
5. Chooses emergency cost structures and elements; and
6. Provides emergency financial reports for in-depth analyses.

The Emergency Finance Budget Management Module corresponds to the IT Service Finance Management Process in ITIL. The model's architecture is shown in Fig. 2.6.

The Emergency Finance Budget Management Module (see Fig. 2.6) has three components: Finance Budget Interface, Knowledge Interface, and Finance Budget Processor. Finance Budget Interface handles the interactive information about emergency finances and budgets between this module and the Command and Coordination Center Module. Knowledge Interface retrieves the knowledge related

Fig. 2.6 Architecture of the emergency finance budget management module



to finance budget and accounting. Finance Budget Processor functions are identifying approved emergency plans, proposing budget targets, preparing financial plans, managing and paying relief funds, carrying out cost accounting, monitoring emergency operation costs, evaluating the balance of cost and effectiveness, and providing financial reports to emergency decision makers.

2.7 The Emergency Organization and Activity Management Module

The nature of emergencies, especially mass emergencies, means that emergency management teams usually have to make decisions in stressful situations, full of ambiguous information, information overload, and a high level of uncertainty. This requires knowledge-based non-routine problem solving skills (Schaafstal et al. 2001). Emergency management requires teamwork across many teams from different organizations with different goals and cultures that are working together to minimize damage and loss from the emergency.

Emergency management requires good coordination and communication within and across teams. Not all emergency teams are effective or efficient when performing emergency activities (Siassakos et al. 2011). Effective performance evaluation of emergency response activities can help emergency organizations to identify missing relief activities and improve the efficiency of their emergency operations.

To manage organizations and emergency activities, an ERDSS needs an emergency plan execution system to undertake rescue activities and center for emergency scene information collection to provide feedback to the emergency command and coordination center. The Emergency Organization and Activity Management Module meets these requirements.

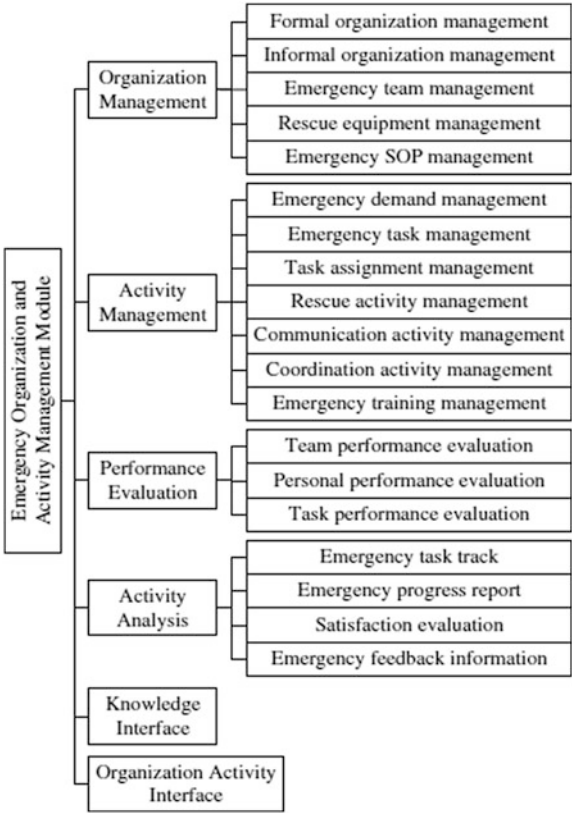
The Emergency Organization and Activity Management Module provides the following services:

- 1. Manages organizations, personnel, and rescue equipment;
- 2. Manages and monitors emergency rescue activities;
- 3. Supports rescue performance evaluation;
- 4. Executes emergency plans; and
- 5. Collects emergency scene information.

The Emergency Organization and Activity Management Module corresponds to the Incident Management process in ITIL. The module’s architecture is shown in Fig. 2.7.

The Emergency Organization and Activity Management Module (see Fig. 2.7) has six functional components: Organization Management, Activity Management, Performance Evaluation, Activity Analysis, Knowledge Interface, and Organization Activity Interface. Organization Management manages various emergency organizations, personnel, rescue equipment, and facilities. Activity Management manages emergency rescue tasks, assignments, activities, training, communications, and

Fig. 2.7 Architecture of the emergency organization and activity management module



coordination. As one type of activity management, communication activity management handles formal and informal contacts, including phone calls, text messages, meetings, and so on. Coordination Activities Management resolves conflicts in rescue processes.

Performance Evaluation runs cost-impact analysis and other processes to improve the performance of emergency organizations and activities. Activity Analysis monitors the progress of emergency rescue activities, assesses emergency plans, and provides timely feedback to the Emergency Command and Coordination Center.

Knowledge Interface retrieves relevant knowledge from the knowledge warehouse. Organization Activity Interface deals with interactive information between this module and the Command and Coordination Center Module.

Blogs now have a low threshold and a very large internet presence, so they can assist us to collect information; however, emergencies are often powerful and destructive, making it increasingly difficult to locate valuable blogs. ERDMSS can solve this difficulty by clustering analysis and text analysis. We can identify target blogs with an emergency response theme for emergent events by combining a vector space model with a single scan clustering algorithm.

2.8 The Emergency Knowledge Warehouse Module

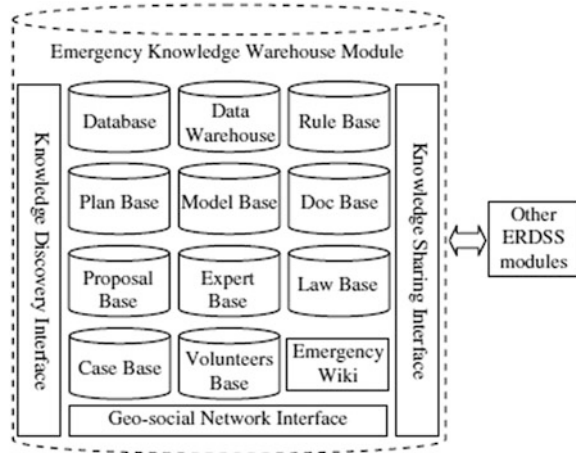
Knowledge can increase our capacity to take effective action. Emergency response knowledge can help emergency decision makers and managers to resolve problems effectively that they have not encountered previously. An emergency response system architecture embeds the knowledge required to support more effective emergency decision-making under different scenarios (Hernandez and Serrano 2001). What kind of knowledge is useful in the emergency response process? How can decision makers apply knowledge better in emergency decision-making and rescue activities? These emergency response problems need to be solved.

To make effective use of emergency knowledge, an ERDSS needs a warehouse to store different types of emergency knowledge and a decision support tool to support the emergency response. The Emergency Knowledge Warehouse Module meets these requirements.

The Emergency Knowledge Warehouse Module provides the following services:

1. Provides a warehouse for organizing and storing knowledge;
2. Offers emergency knowledge and analytical tools to support emergency activities;
3. Provides users with knowledge and interfaces to acquire knowledge from outside the system;
4. Enhances system intelligence; and
5. Improves emergency response capabilities.

Fig. 2.8 Architecture of the emergency knowledge warehouse module



The Emergency Knowledge Warehouse Module corresponds to the Capacity Management Process in ITIL. The model's architecture is shown in Fig. 2.8.

The Emergency Knowledge Warehouse Module (see Fig. 2.8) has 15 functional components. The database stores current emergency response transaction data. The Data Warehouse stores historical emergency data to support data mining and online analytical processing (OLAP). Plan Base receives prepared emergency plans from the Emergency Plan Management Module and sends appropriate plans to the Command and Coordination Center Module.

Proposal Base stores formatted proposals from the Emergency Service Helpdesk Module to conduct further analyses. Model Base saves models and algorithms, such as plan analysis, route optimization, rescue budget, and simulation models. Case Base stores complete descriptions of typical emergencies. Rule base store structured emergency knowledge and experience. Doc Base stores documented knowledge such as reports, videos, and audios. Law Base stores laws and regulations related to emergency response and reflects the characteristics of e-government. Expert Base and Volunteer Base store information about emergency experts and volunteers respectively. Emergency Wiki is a wiki for emergency response purposes. A wiki is a type of website that allows users to add, modify, and delete its content via a web browser by using a simplified markup language or a rich-text editor (Lykourantzou et al. 2012). Knowledge Discovery Interface provides knowledge discovery tools and captures or collects emergency knowledge. Geo-Social Network Interface manages volunteer communities and captures the geo-positions of community members by connecting existing or new geo-social networks via specific APIs (Application Programming Interface). Knowledge Sharing Interface provides knowledge to support other modules in the ERDSS.

In case of flood emergency response, the case history database is collected to form a flood case and a case study is used to retrieve similar cases. The case description is based on ontology to provide a structured description framework for

case knowledge. It provides an effective tool for knowledge management of historical cases. The system can use the current case automatically to generate the rescue plan based on historical cases and knowledge-mining rules, accelerate the formation of the rescue plan, and improve the organization’s emergency management ability.

2.9 The Emergency Warning Management Module

Emergency warning or forecasting is an important function of emergency responses. Emergency warning or forecasting can help decision makers to take emergency measures and reduce disaster losses as early as possible. An ERDSS needs forecasting facilities to predict possible emergencies. The Emergency Warning Management Module is designed for emergency prediction.

The Emergency Warning Management Module provides the following services:

1. Collects safety information;
2. Supports prediction algorithms and data analysis;
3. Provides security status threshold settings; and
4. Manages related facilities and personnel.

The Emergency Warning Management Module corresponds to the Service Desk process in ITIL. The model’s architecture is shown in Fig. 2.9.

The Emergency Warning Management Module (see Fig. 2.9) has two functional components: the Warning Management Processor and the Warning Interface. The Warning Management Processor collects and analyzes safety information and sends warning information to the Emergency Service Helpdesk Module. The safety information collection component inside the Warning Management Processor

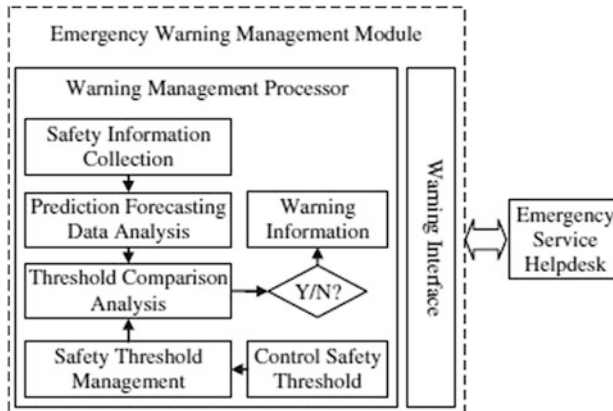


Fig. 2.9 Architecture of the emergency warning management module

gathers relevant data in major protection areas on a regularly and irregular basis. Safety information is obtained from personnel and purpose-built facilities. The emergency prediction and forecasting functional component analyzes scattered data gathered by the safety information collection functional component. The data threshold for security status is responsible for security alerts and controls various safety standards in the warning process. Warning Interface handles the interactive information between this module and Emergency Service Helpdesk Module.

A 6.5 magnitude earthquake occurred at 16:30 on August 3, 2014, in Zhaotong Ludian County, Yunnan. In the face of such an emergency, forecasting the demand for materials, raising, scheduling, and monitoring materials, and feedback links rapidly generated the need for up-to-date information. That is to say, these activities are prone to stagnation. The first reaction after the accident is very important. The command and control group needs to have demand forecast experts and to construct the Petri net model of the scheduling process for urban emergency supplies. With these resources, the group can rapidly identify the right kinds of goods and forecast the approximate number, thereby reducing the delay caused by uncertain resource allocation decisions.

2.10 The Emergency Alarm Management Module

Emergency alarms report emergency information to related organizations and departments when emergencies occur. Emergency alarms should involve both government departments and the public. The Emergency Alarm Management Module in an ERDSS collects emergency and demand information and provides emergency proposals and feedback to the Service Helpdesk Module. Lu and Yang (2011) proposed a hierarchical model to examine the mechanism of exchanging information about natural disaster responses in virtual communities.

The Emergency Alarm Management Module provides the following services:

1. Collects emergency information;
2. Collects emergency rescue demands;
3. Collects emergency response feedback;
4. Provides emergency rescue proposals submitted by the public; and
5. Connects external information.

The Emergency Alarm Management Module corresponds to the Service Desk process in ITIL. The model's architecture is shown in Fig. 2.10.

The Emergency Alarm Management Module (see Fig. 2.10) has four functional components: Dedicated Alarm Facilities, Emergency Call Center, Internet Emergency Information Center, and Alarm Interface. Dedicated Alarm Facilities detect and transmit emergency information to the Service Helpdesk Module. The facilities include special equipment and an information collection system. The Emergency Call Center receives various emergency telephone calls and cell phone

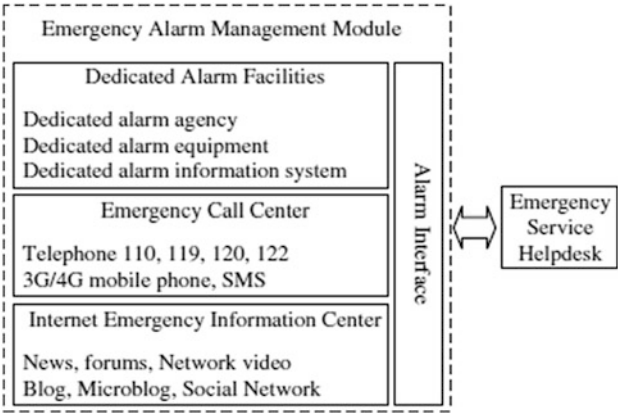


Fig. 2.10 Architecture of the emergency alarm management module

text messages. The Internet Emergency Information Center collects emergency information and proposals from the Internet. Alarm Interface handles the interactive information between this module and the Service Helpdesk Module.

The alarm management system can use RFID (Radio Frequency Identification), or other electronic tag information storage and marking functions with GPS satellite navigation and positioning technology, for monitoring and commanding storage and freight vehicles for emergency rescue supplies to form a “point-line-plane” real time weather information network. This system achieves precise positioning of freight vehicles, dynamic tracking, process control, and visualization management through the seamless integration of GIS and GPS location information. GPRS (General Packet Radio Service) communicates across the entire regulatory platform to achieve real time monitoring management of disaster rescue and disaster mitigation. This enables timely and reliable alarm and emergency calls when the GPRS identifies freight route deviation, freight vehicles pause timeout, and other abnormal conditions, thus ensuring safe and efficient delivery of rescue supplies.

2.11 The Problem Analysis and Management Module

Most emergency response activities cease when an emergency is over. However, there is no guarantee that the causes of the emergency have been identified and measures taken to prevent such emergencies in the future. In fact, similar emergencies may occur again. Therefore, emergency researchers must analyze the causes of emergencies and defects in the emergency response processes that were put in place. The Problem Analysis and Management Module in an ERDSS runs these analyses.

The Problem Analysis and Management Module provides the following services:

- 1. Accepts problem analysis instructions or requests;
- 2. Classifies and defines emergency problems;
- 3. Investigates, diagnoses, and analyzes problems;
- 4. Manages analyses and proposals;
- 5. Manages problem solutions and monitors implementation.

The Problem Analysis and Management Module corresponds to the Problem Management process in ITIL. The model’s architecture is shown in Fig. 2.11.

The Problem Analysis and Management Module (see Fig. 2.11) has five functional components: Problem Classification and Control, Cause Analysis and Research, Solution Design and Evaluation, Report and Proposal, and Problem Interface. Problem Classification and Control identifies and diagnoses problems. Cause Analysis and Research analyzes and evaluates the causes of problems. Solution Design and Evaluation designs and evaluates problem solutions. Report

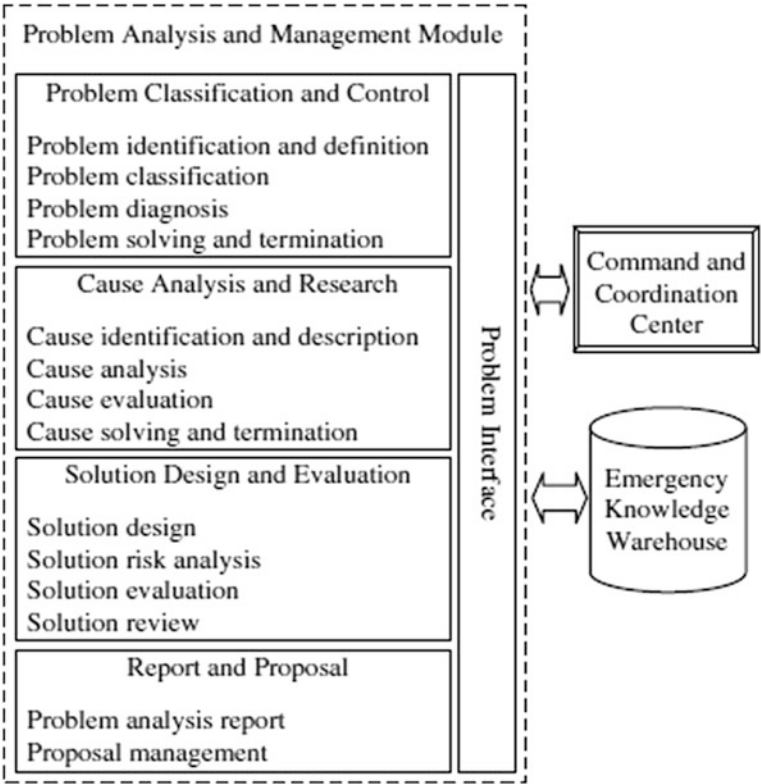


Fig. 2.11 Architecture of the problem analysis and management module

and Proposal generates formatted reports and proposals and submits them to the authorities. Problem Interface is a window that allows this module to interact with other modules.

The Q & A community studies natural disasters and investigates the characteristics of the problem and the answer. The theory and method of collecting characteristics relate to the quality of answers, in order to start from a topic and select the highest quality information. Text features and the characteristics of the indicators are selected and analyzed; the purpose is to evaluate the quality of the answers automatically. User satisfaction is the criterion for measuring the quality of the answers.

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