

NATURAL DISASTER DATA AND INFORMATION MANAGEMENT SYSTEM

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ABSTRACT:

To have a strong management commitment and cooperation for natural disaster contingency, the development and implementation of application software as natural disaster data and information management is very important. This paper describes the three main components namely Communication, Data Distribution and Data Management Systems suggested as a solution for natural disaster data and information management to reduce the cost and time for contingency and decision-making in Malaysia. Communication system will provide a real-time data and information to support control centers and operating agencies related to disaster monitoring, mitigation and enforcement. Data Distribution system is responsible for information retrieval, extraction. Data Management System functions principally to support value-added data and information requirements of the disaster management unit and the national coordinator of disaster and relief in the country. Other subdivision integrated with natural disaster data and information management system are described.

1. INTRODUCTION

Hazard is defined as an incident, which occurs in a sudden manner, and complex in its nature and that causes losses of lives, damages to property or natural environment and bring a deep effect to local activities. Such incident needs a management that involving extensive, resources, equipment, skills and man power from many agencies with an effective coordination, which is possibly demanding a complex action and would take a long time. While the vulnerability varies from region to region, a large part of the country is exposed to such natural hazards, which often turn into disasters causing significant disruption of socio-economic life of communities leading to loss of life and property (BMTPC, 2001).

For natural disaster contingency, it is very important during the development and implementation of the application software to have strong management commitment and cooperation. Many projects on hazard management; contingency planning and decision support systems are implemented for natural disasters in the entire world according to geographical situations and disasters involve. For each disaster, too many database and software have been developed and designed and millions of money has been expended. These projects are substantially costly and the main problem are the existing of many parallel sub-systems and activities and repeat labour works in different database format which have to be created for each hazard management systems. Such methodology will be so complicated due to implementation of different platform, different database format, and different program languages and so on. This will make all projects costly and non-efficient.

Our proposed new contingency planner for hazards is a batch system (Figure 1) containing, Data Distribution Center (DDC); Data Validation Center (DVC); Data Processing and Application Development (DPAD); and Decision Support

System (DSS). This combined organization makes a natural disaster data and information management system and can be employed for national hazard contingency as a solution for all different hazards in countries involved.

2. HDSS COMPONENTS AND FUNCTIONALITIES

Hazard Decision Support System (HDSS) refers to the scheme, which has to be developed to cater requirements of pre, during and post disaster activities. This organization has to utilize latest available communication and information technology to equip users with on-line system accessible via private network, Internet connectivity or data radio communication infrastructures. Depending on convenient during operation particularly during the events of disaster, user can use devices such as mobile data terminal and PDA to send and retrieve information as required in performing their respective functions and duties. Urgent information can even transmitted to mobile phones in the form of SMS.

Among main features and functionalities of HDSS those related to Decision Support System (DSS), Reporting Wizard (RW), and Data Management System (DMS) enable administrative and operational functions to be carried out more efficient as well as cost effective. HDSS organization consists of application modules that cater all requirements of disaster activities. Figure 1 shows the organization of this hazard management system and the main component of that can be classified as below:

2.1 Data Suppliers

Data suppliers are government and non-government organizations that will support daily and/or required data in the event of requirement. Crisis and Disaster Management Unit, Division of National Security of the Prime Minister's Department (KDN), Department Environmental Council, State District Office MACRES, Fire Rescue Department, Marine Department, Royal Malaysian Navy, Royal Malaysian Police, Department of Public Works, Department of Forestry, Department of Minerals and Geosciences, NREB, MMS, JPS, BOMBA, MCC, MECC and DOSH, are examples of the data suppliers for HDSS in Malaysia.

Format of data are quite variable such as Air/Satellite data, data from various sources, images, vectors, maps, databases, GPS, ETC, Satellite communication system and site monitoring, workstation, detection devices on site, hot links and so on.

2.2 Data Distribution System (DDS)

At the interface level, the DDS has the functionality of administrating user and portal. It manages data information distribution by controlling who gets what, at in different time, at different places. Its functionality can be summarized as follow:

- Perform rapid and accurate mapping of disaster evolution
- Easy, efficient and enable real-time communication
- Able to support the distribution of data
- Support at central level, the configuration users' profiles and security issues
- Serves the needs of emergency managers that include the on-scene commander and management of the personnel in the field
- Serve the needs of operational crews that include all squads in charge of various field activities

DDS have three main capabilities; Data verification, Quality control and Data storage services to all incoming and outgoing data. There have to be a sub system as portal to manage all incoming and outgoing transaction.

In the DDS, data/information have to be managed and stored properly. The quality of the data including its format will be strictly controlled so that it can be used throughout the system.

2.3 Data Management System (DMS)

DMS is a collection of state-of-the-art hardware and software that can be used for the management of disaster at every stage of the crisis before, during and after. It has to be designed in a modular and expandable architecture concept and have to be able to evolve later in an incremental way through the integration of new sensors, the implementation of new centers and actors (fixed or mobile) and the integration of new application software when available.

2.4 Data Processing & Application Development (DPAD)

Data processing and application development part contains thematic application analysis tool, which divides into thematic applications for natural disaster, namely Flood, Forest Fire, Oil Spill, Landslide and Hot Installation and other disasters involve with the certain region. These thematic products and disaster application management system employ relative data processing input such as satellite data. Figure 2 represents a satellite-based data processing for forest fire as an example of data processing and application development part. Thematic products and disaster application management system will also employ relevant model of the disaster for decision-making tool in a Geographic Information System (GIS) environment. Figure 3 presence a GIS based data processing and application development for a Hot Installation disaster management. This system gives an efficient and reliable hazard forecasting and monitoring. Satellite or ground based early warning, detecting, monitoring, and mitigation are functionality of the system by creating thematic maps, situational analysis, vulnerability analysis, damage and risk analysis, using GIS.

2.5 Decision Support System (DSS)

DSS is an information system for disaster management and relief. It is a central database, where data and information can be made available on-line basis. It is an intelligent system, to help planning activities. It is also an electronic-based correspondence system report generator that can be modified according to the user. Whole responsibility of this part are; damage assessment, thematic hazards maps, proposed solutions, early warning, Decision support, risk prediction, and situational analysis.

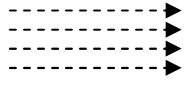
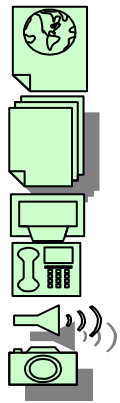
3 REVIEW AND CONCLUSIONS

Formulation of strategic implementation plan needs to be taken for an effective disaster management system. To achieve success in these aspects, creation of natural disaster data and information management system should be given prime importance among policy initiators, decision makers, and administrators at national and local levels, professional bodies, financial institutions, NGOs and voluntary organizations. The scope of disaster management activities need to expand implying participation of wider range of stakeholders in much wider range of activities. Local government institutions need to build up their capacities in order to meet the growing demands in the area of disaster management. Detailed databases need to be created on hazard occurrences containing damages caused to buildings and infrastructures and the economic losses suffered and its accessibility should be ensured regarding preparedness, and research data for effective pre and post disaster analysis with data on mitigation techniques and action plans.

National level institutional mechanism should be enhanced to assist and advise in formulating short and long-term disaster preparedness, mitigation, and prevention techniques.

DATA SUPPLIER

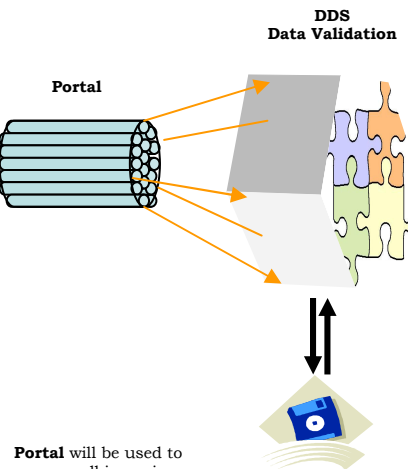
Data Supplier



- Air/Satellite Data
- Data from Various Sources
Images, Vectors, Maps, Databases, GPS ETC...,
- Satellite Communication System and Site Monitoring Workstation
- Detection Device on Site

DDS (Data Distribution System)

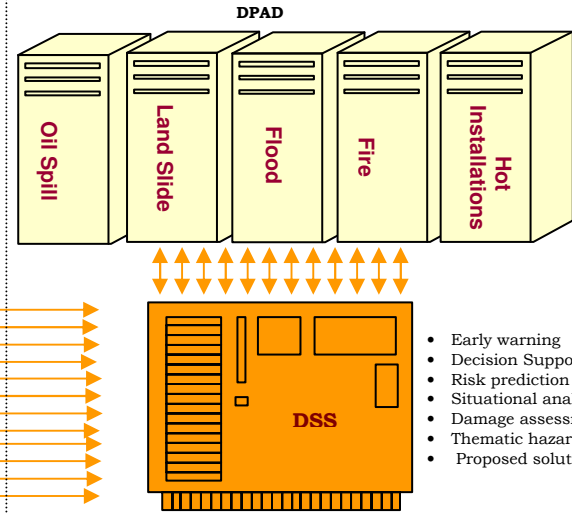
- DDS have three main capabilities:
- Data verification
 - Quality control
 - Data storage services to all
 - Incoming and outgoing



Portal will be used to manage all incoming and outgoing transaction.

Back Up data
In the DDS, data/information will be managed and stored properly. The quality of the data including its format will be strictly controlled so that it can be used throughout the system.

DMS (Data Management System)



All value added thematic application products and analysis will be generated and done at this level.

- Early warning
- Decision Support
- Risk prediction
- Situational analysis
- Damage assessment
- Thematic hazards maps
- Proposed solutions

Figure 1: Natural Disaster Data and Information Management System configuration

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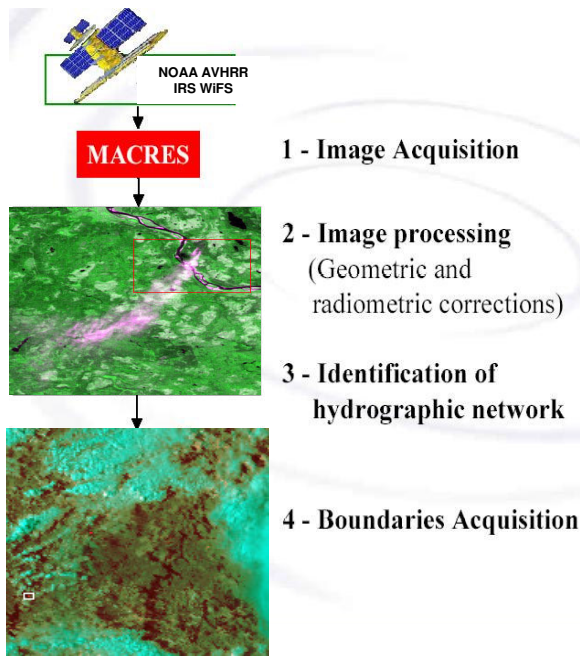


Figure 2: Satellite-based data processing for forest fire as an example of data processing and application development.



Figure 3: GIS based data processing and application development for a Hot Installation disaster management