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Development of Cross-Media Database for Sharing Disaster Information and A Case Study about Implementation Process

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Synopsis

Cross Media Database is a research support information infrastructure (RSII) being developed for researcher. Cross Media Database provides a framework in which researchers can catalog, store, retrieve, search, browse, discover, and visualize information effectively, and examine a broad range of information related to their research topics efficiently. Cross Media Database is based on the principle that resources have "relationships" to other resources. Additionally, Cross Media Database utilizes spatial and temporal display interface to present the distribution of information geographically (GIS function) as well as chronologically. It also provides detailed information about resources by storing metadata and digital files. This paper describes how to perform Cross Media Database for researchers and shows a case study about implementation it.

Keywords: Cross Media Database, RSII, Multi-Resource Type, Relationships, Metadata, GIS

1. Introduction

We have exposure to the menaces of multi-hazard (An event and the situation of physics to bring the damage in individual and society. e.g., damage of human, property, infrastructures, environment, impact of economy and others), which are not only natural disasters such as an earthquake disaster, storm and flood, and volcano disaster, but also new type of pneumonia SARS outbreak and the terrorism of the NY World Trade Center building on September 11, 2001.

In this appearance, federal and local governments have various countermeasures in order to mitigate and reduce damage effectively. Research organization such as university also has many research topics concerning to many kind of disaster study fields at the same time. Disaster study fields are classified a disaster phenomenon such as exogenous force of disaster or damage, disaster science such as disaster information, social engineering such as civil engineering or statistics, systems engineering, social science such as social engineering, psychology or sociology, economy and history of disaster and each researcher achieves results of research by their own way of collection, processing, analyzes information.

In collecting information as important process of research, researches of disaster collect information by visiting the hot spot such as disaster area or place for interview for their research, or in recently they search and collect information by using Internet search engine. Researchers spend much time and labor till they collect information they need.

It is thought that needs of researchers to study effectively are below.

1. They might look for information to need by a

little time and labor, and can obtain it.
2. They might need quality of data is high so that they can understand about data itself stored database and contents easily.
3. They might need interdisciplinary database that does not depend on a type of a resource (e.g., book, report, thesis, still image, spatial data).

In addition, database might be needed that can store data of result as well as knowledge that was arise by processing, unification and analyzes data by other researchers, and based on international standard's data set not a thing specialized in a research organization of Japan. A database satisfying these points of view will be a sustainable database in the future, and it can be a comprehensive database stored raw data, descriptions of contents of data and knowledge.

In this paper, we place this structure and concept of a comprehensive database as RSII (Research Support Information Infrastructure) and aim to describe the functions of Cross Media Database through user interface and implement case study based on Cross Media Database.

2. Concepts and User Interface of Cross Media Database

2.1 Concepts of Cross Media Database

Researchers of disaster domain studies will have needs that they want to use many kinds of resource types effectively. Cross Media Database is a database having the following characteristics in consideration of needs of researchers.

1. Cross Media Database can store many kinds of resource types, media types (Physical objects stored data/information, e.g., Paper, Film, Compact Disc and DVD) and format types (Format of Digital data or Physical, e.g., Text, Doc and Spreadsheets) as comprehensive database. Cross Media Database can store 12 resource types of data. (Audio, Data, Document, Event, Geospatial, Image, Internet, Model, Organization, Person, Study, Video)
2. Cross Media Database makes use of metadata set as international standard and integrate multi resource types by using metadata.
3. Cross Media Database defines the relationship explicitly between resource types and authorize it.
4. Cross Media Database has functionality that can retrieve and view to be based on Time / Geospatial.
5. Cross Media Database has expansibility and flexibility that we can add functions and definitions in correspondence with needs of stakeholders.

2.2 Architecture of Cross Media Database

Cross Media Database has two applications that one is "Cataloger" to supply functions in order to create metadata and the others is "Resource Retriever" involved functions that search and query and view of result as user interface to access to database. These user interfaces are core applications and mainly have role as a client with function that load information of resource to database, send request to server in order to search and view, display some results. Cross Media Database also has other component that involves function as server that doesn't appear interface and the architecture composes of 4 tiers as shown Fig. 1

1. Application Tier

Application Tier composes of two applications that are"Cataloger" and"Resource Retriever" and involves components below.

a. Cataloger

- Data Entry Tool: User, mainly administrator input metadata of resource from this interface.
- Catalog Tool: User, mainly administrator edits definitions, for example, they are control vocabulary and a classification item.

b. Resource Retriever

- Search and Query Tool: A user searches about a resource thorough this interface. As for the search results, it is displayed a tree according to a resource.
- Metadata Display Interface: The metadata of the resource are displayed by choosing a resource displayed by search results of Search and Query Tool. All the displayed metadata are information input in Data Entry Tool of Cataloger.
- Timeline Display Interface: This interface displays a resource by search results of Search and Query Tool in chronological order (e.g., published date, date that data were made and a lecture was).
- Spatial Display Interface: This interface displays a resource by search results of Search and Query Tool in chronological on the map. For example, we can know the place where data was collected, a lecture was held and a picture was taken.

2. Service Tier

A service layer consists of a component offering the function that the application layer that is a client in a cross media database requests.

a. Catalog and Search Web Services: Catalog and Search Web Services is aggregation of Web Service that provides functions that store new data concerning to resource and edit or delete information that already has been in database. This is main interface for an application of a user client to access Cross Media Database and a server function. This is built by using Web service so that we can call from any kinds of clients based XML/SOAP.

b. Search and Query API: Programming interface in order to send a request of a search and a query from a client application to Cross Media Database, and return a request to a client as an assigned format.
c. ArcIMS and ArcIMS Service: GIS server software and service to serve a map on Internet.

3. Data Access Tier
a. Data API: Data API is object type programming interface-enabling access to a database. User can extract the data stored in Cross Media Database through this interface. This is included some classes to support deferent database.
b. ArcSDE: ArcSDE is server software to store Geospatial data in Relational Database.
4. Data Tier
a. Cross Media Database: We name all database repositories generally and call it a cross media database. This involves metadata about all resource types and geospatial data from SDE.
b. Spatial Footprint: Spatial Footprint is spatial data to store location information related to a resource.
c. XML Metadata: XML Metadata is metadata about spatial data of a XML format created by ArcCatalog.
d. Local Resource Data: Local Resource Data is digital resource, for example, MS Word, MS Excel, PDF, Image data.

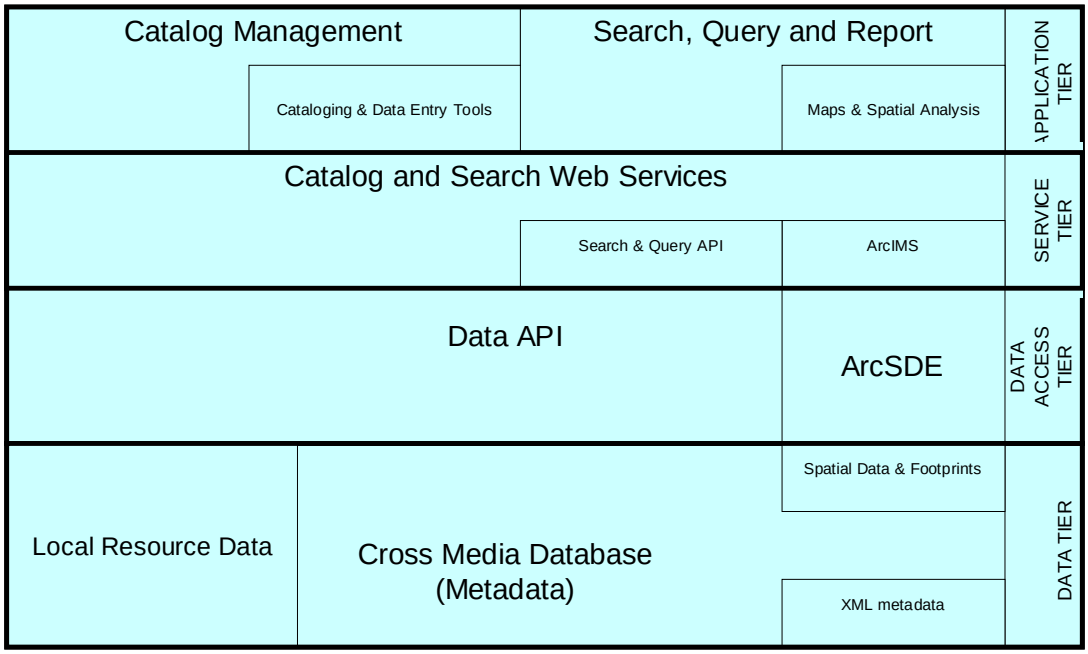

Fig. 1: Architecture of Cross Media Database

2.3 Interface of Cross Media Database

Cross Media Database mainly two interfaces which"Cataloger" and"Resource Retriever".
Fig.2 shows the Data Entry Tool to input metadata for user, mainly administrator. In the Data Entry Tool, user input fundamental elements of metadata.

Fig.3 shows Search and Query Tool to retrieval resources. If users search resources by free keyword, users can browse results as multi-resource types and reach the resource directly they need.

In addition, users can search resources in detail by using advanced option as shown Fig.4. Some researchers might need data of one resource type. Cross Media Database can search resources for each resource type as shown Fig.5.

Fig.6 shows the view of metadata as results by retrieval. Users can understand the detail of resources by this interface. At the same time, user can know the relationship explicitly between resource types and can access other related data easily. In addition, user can download and view raw data stored database from this interface as shown Fig.7.

Fig. 8 shows the view interface searched results chronologically. Users can plot resources to chronological template automatically after retrieve resources by keyword and know creation date or content date of resources by easy way of view. It is useful for researchers to know easily time and contents of resources at the same time. For example, we might want to know when the data is created or is updated and when information is after the disaster.

Fig.9 shows the view interface searched results by using GIS function. As mentioned above, generally, though geospatial data has information about location in itself, all resource type can have footprint. So users can identify where monitoring data is observed and where picture is taken with location data, map and contents of resources at the same time.

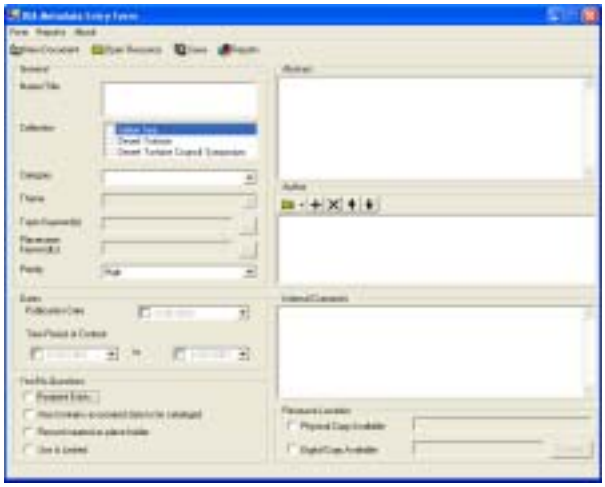

Fig. 2: Data Entry Tool

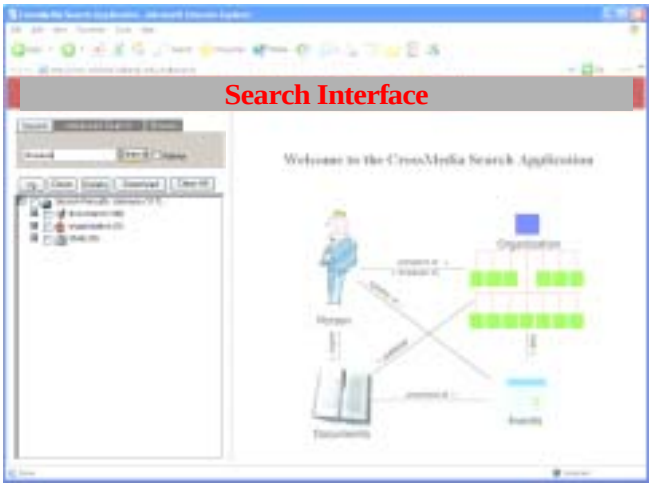

Fig. 3: Basic Search Interface

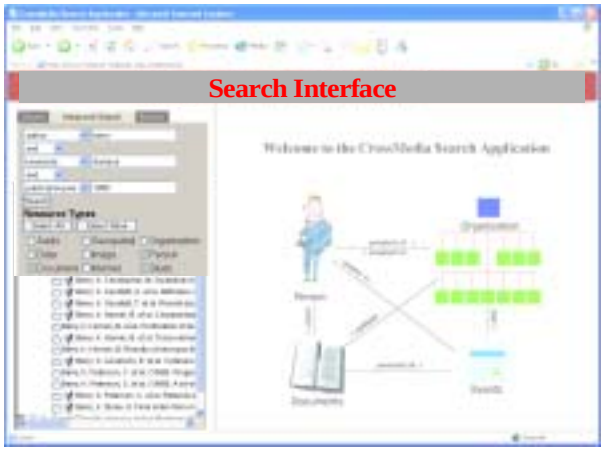

Fig. 4: Advanced Search Interface

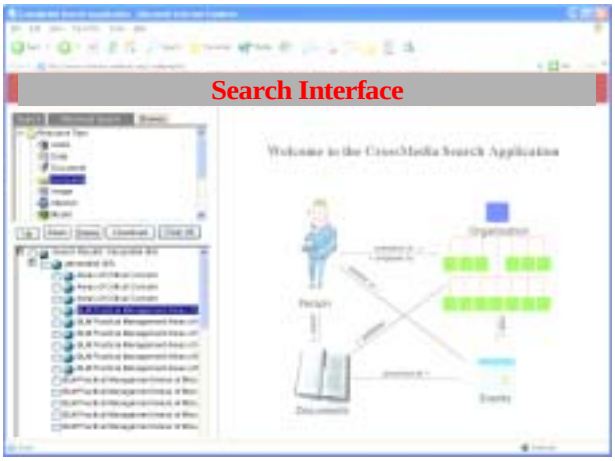

Fig. 5: Retrieval for Each Resource Types

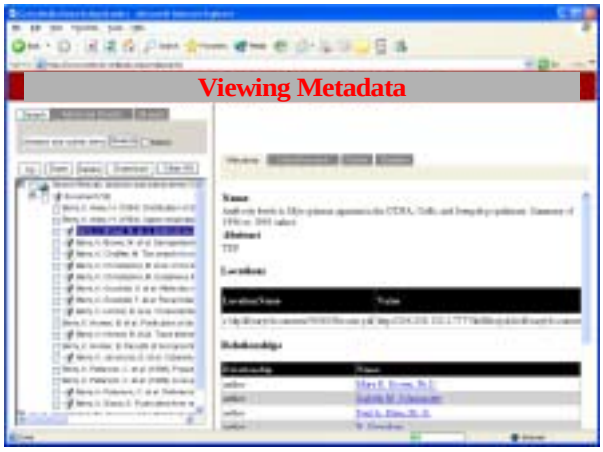

Fig. 6: View Interface of Metadata

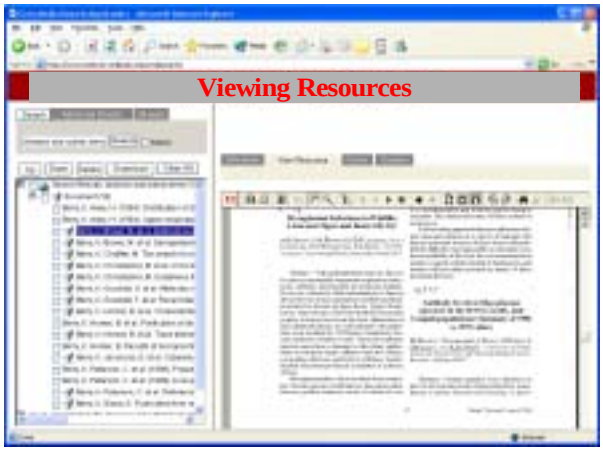

Fig. 7: View Interface of Resources Itself

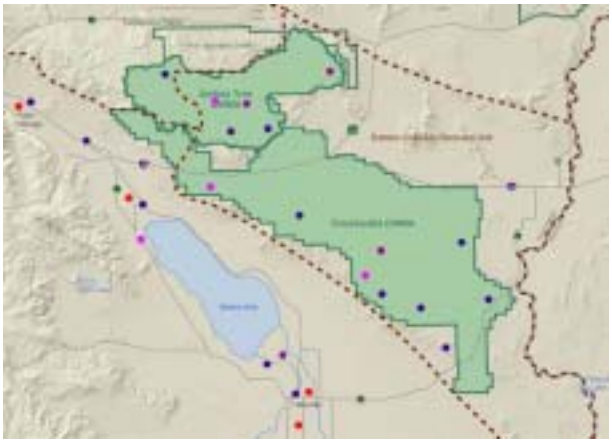

Fig. 8: Map View of Resources

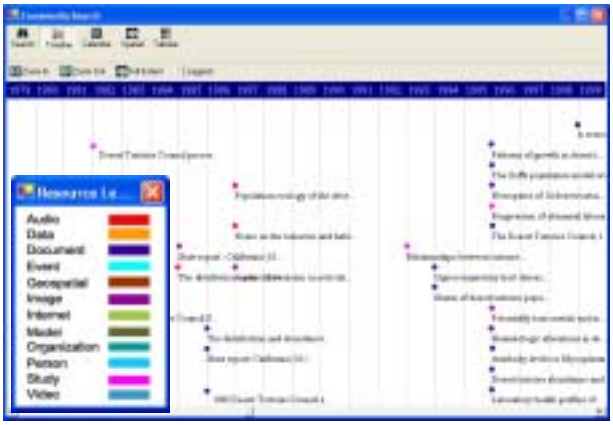

Fig. 9: Chorological View of Resources

3. A Case Study about Implementation Process

Since we aim to develop the Cross Media Database attending stakeholder of Disaster study domain, we had a case study based on Cross Media Database.

3.1 Outline of Case Study

In this case study, we aim to store experience of people who suffered by Hanshin Awaji Greate Earthquake and knowledge that we can obtain to store information based on Cross Media Database. Firstly, we had interview to person who is urban planner and a victim by Hanshin Awaji Greate Earthquake. He had 9,000 images and a daily in those days and two resources recalled his memory.

This case study also aims to construct system that others can understand these experiences at the same time.

3.2 Contents of Interview

In interview, he gave a lot of information to us. Information that he gave us is divided 4 points of view as follows.

1.Information was mainly talked about some events that involved damage, fire and ceremony.

2. Information was talked the time and place about events.

3. Information was talked the key person related to events.

4. Information was talked referred by related books and videos.

These points of view mean he gave us information by focused events that had reference to time, place, related person and book.

Information we stored in this interview is adapted to resource type of Cross Media Database. These resource types are event, image, document, organization, video, people, data and Internet. As we mentioned above, Cross Media Database has functionality that it can define the relationship explicitly between resource types and authorize it.

Then we defined the relationships between resources that collected by interviews. As shown Fig. 10, resources by interview can have relationships that define Cross Media Database. Moreover, relationships have two types bellow.

1. The relationship is used as reference such as interview related to image, diary, and map book. (Cross Media Database define the relationship that “Resource A “ is referred to “Resource B “). It is useful for others to understand the contents of interview without interview.

2.The relationship is used to integrate some resources. As shown Fig.10, interview was implemented by using a lot of images and a diary. We noticed that if others understand his experiences with images, we must set one unit consisted of some images. So we integrated his experiences to a video with audio of interview and continuous images. In addition, if related information about his experiences is same place, it is easy for others to understand his experience. In order to satisfy this purpose, we created html pages involved audio, video, text, and image. (Cross Media Database define the relationship that “Resource A“ is generated for “Resource B “ and Resource C “).

This means researcher create their knowledge in the process of their study that they collect, process, analyzes information. Some researchers also might make use of observation data and create their model to calculate earthquake ground motion and others might calculate simulation with statistics (the number of population and building) and ground motion. This process is same to create knowledge in their study process.

The relationships defined in Cross Media Database as above are useful way to inform researcher’s knowledge to others.

Fig. 10: Relationships in Interview

3.3 Implementation using Cross Media Database

We stored many resource types that we collected and created through interview, and described metadata in Cross Media Database, and we implement how Cross Media Database performs for researchers under the assumption that others will use this database.

In this case study, the person who was interviewed was urban planner, so many resources were related to the specialties about urban planning.

As shown Fig. 11, user input the keyword “Machizukuri” with interest and received the results of multi resource type and user can get information about key person in detail from metadata.

Moreover, user can find the relationships related to the person and refer to event and images. As shown Fig. 12, if user accesses the relationship of event (“Fukkoh Machizukuri / Honne wo Kataru”), user can know the contents of events and the relationships that involved video and participations of the event.

3.4 Extension

We noticed that geo-location was important for us to understand the contents of interview with the topic and time because the experiences in interview are often talked based on place name. At the same time, might think overlay our data set to others. As

Fig. 11: User Interface 1 to Implement Case Study

Fig. 12: User Interface 2 to Implement Case Study

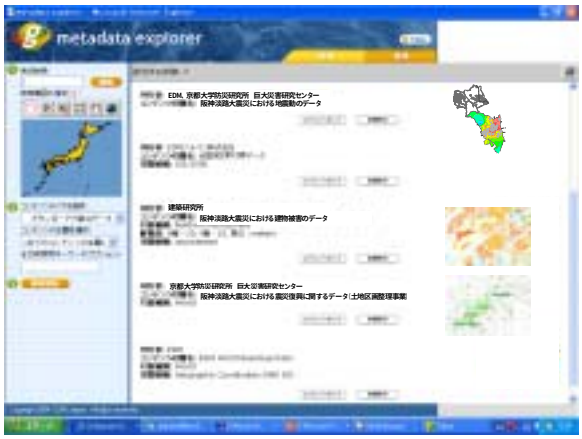

Fig. 13: User Interface to Share Geo-Spatial Data Set

shown Fig.13, we are trying to develop the extension of Cross Media Database regarding to geospatial data. Fig. 13 shows the Geographic Network in order to share geospatial data set. Geographic Network is key component and user can get metadata information about dataset and download the dataset.

This means that user can understand the contents of dataset and make use of it for own study without set complicated geo-processing process. For example, in

Fig. 14: Linkage to the Geography Network

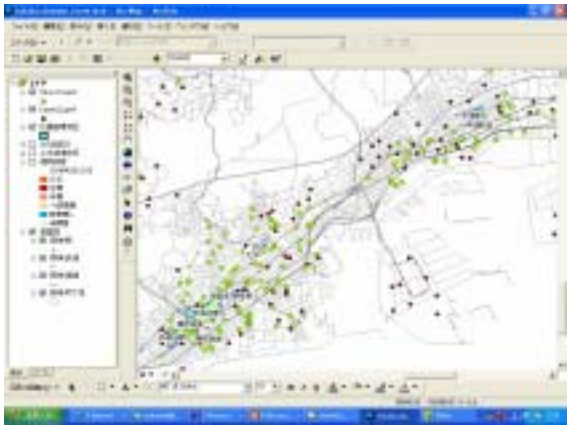

Fig. 15: Download the Spatial Dataset

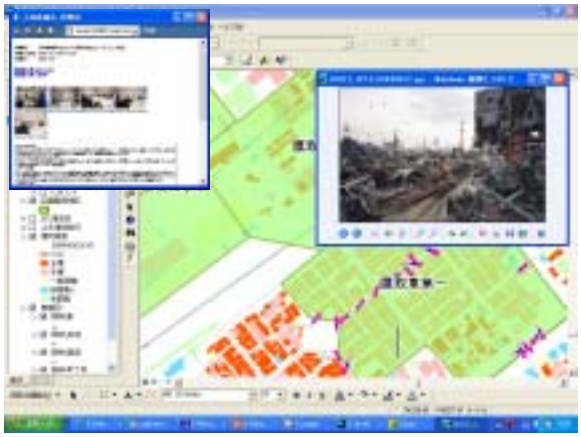

Fig. 16: Overlay the Spatial Data

Cross Media Data Base, user search some resources by keyword " Tochikukakuseirijigyou" and user can get not only metadata but also geospatial data set by jump Geographic Network as shown Fig.14.

As shown Fig.15, user can download data set about recovery process after Hanshin Awaji Great Earthquake involves Tochikukakuseirijigyou Area, location of public recovery houses and temporary houses. And if user might know the damage of buildings, user can overlay easily as Fig.16 and edit data in local for their study. So Fig.16 shows that we overlay exiting dataset (Recovery data set and Damage of building data set) to our data set involves spatial point linked images and html.

In this process of study for researchers, geospatial extension will be useful function.

4 Conclusions

In this paper, we place this structure and concept of a comprehensive database as RSII (Research Support Information Infrastructure) and aim to describe the functions of Cross Media Database through user interface and implement case study based on Cross Media Database.

In the case study, we implemented to make use of Cross Media Database as a stakeholder.

Since we show the function of Cross Media Database and how to use it, considerations and direction we can notice thorough this the study as follows.

1.Growth / development of Database

We described that Cross Media Database has expansibility and flexibility that we can add functions and definitions in correspondence with needs of stakeholders. This means that Cross Media Database will grow and develop by editing and changing metadata elements; controlled vocabulary and relationships by many stakeholders are attending. We are now step of implementation process and must apply to many kind of study field of disaster domain.

2. Maintaining of Database

We have to try to implement this database for researchers and consider maintaining for long time. We must consider the role, for example, "Who enter metadata?" "Who maintain system in the long run? ". This consideration is significant issues for Cross Media Database as the organization. At the same time, we must try to reduce the work in order to input metadata.

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要　旨

クロスメディアデータベースは防災研究者のための包括的なデータベースとして開発を進めている。本データベースはカタログ、データ蓄積、検索、ブラウズ、検索結果の新しい表示機能を持つデータベースである。本稿では、ユーザーインターフェイスから、その機能を述べた。また、ケーススタディとして、阪神・淡路大震災における被災体験を蓄積、共有するプロセスを通して、クロスメディアデータベースの実践的活用事例を提示した。

キーワード： クロスメディアデータベース，包括的なデータベース，ケーススタディ,実践的活用