# A STUDY AND APPLICATION OF INTERACTIVE GRAPHICS TECHNIQUES IN TOUR INFORMATION IN TAIWAN AREA

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## ABSTRACT

The integrated techniques in the field of interactive computer graphics are highly developed. Meanwhile, tourism is widely broadcasted in Taiwan, Republic of CHINA. As we can realize that, in the near future, tour map will become a very common information and widely used for tourist in here.

This paper explains how CMS introduced interactive graphics techniques in tour map making. The topics in this paper include :

-- Understanding the recent computer-aided graphics system

-- Constructing the suitable database for digital map

-- Graphics information entry

-- Non-graphics information entry

-- Association of graphics and non-graphics information

-- Application of graphics and non-graphics information

## PREFACE

Taiwan, as everybody knows, is an Island Province of the Republic of CHINA. 40 years ago, Taiwan was outlined below:
-- Pool resources
-- $\frac{2}{3}$land is covered by mountains
-- Traffic network system is unconvenience
-- Tourism is undeveloped

After 40 years economic and administrative construction, Taiwan is so far on the way to a develpoed country. There are more than 1,000,000 tourists each year enjoy their holidays here. Under this circumstance, rendering a quicker and convenience service to tourists has consequently become a leading topic in Taiwan. Tour map supporting is also one of that service.

Tour map contains very useful information for a tourist who is travelling around a certain area. The information on the map provides details to tourists as to how interesting a place can be. The more tour information the tour map support, the more convenience the tourist feel.

The CMS is to be responsible to the job of map production. In order to fulfill the demand from the tourist, we use digital techniques to produce the tour map.

# INTRODUCTION

A digital map includes a large amounts of digital datas to Represent the Earth details. In order to enhance the capability of data processing effectively, we use computer as a tool to handle this complicated work

The advantage of using computer-aided interactive graphics techniques are that:
1. it can store quite a lot of attribute information in a database which conventional mapping techniques can not.
2. it is easy to update to reflect changes quickly.
3. it supports multiple selection of map information for users.
4. it provides fast data access and manipulation.

Tour map is one of the thematic map. It includes the following characteristics:
1. smaller scale
2. less graphics information
3. more non-graphics information
4. widely used by all people in any time at any place

## UNDERSTANDING THE RECENT COMPUTER-AIDED GRAPHICS SYSTEM

Figure 1 simply shows a configuration of recent computer-aided graphics system.

| INPUT | PROCESSING | OUTPUT |
| ===== | ========== | ====== |

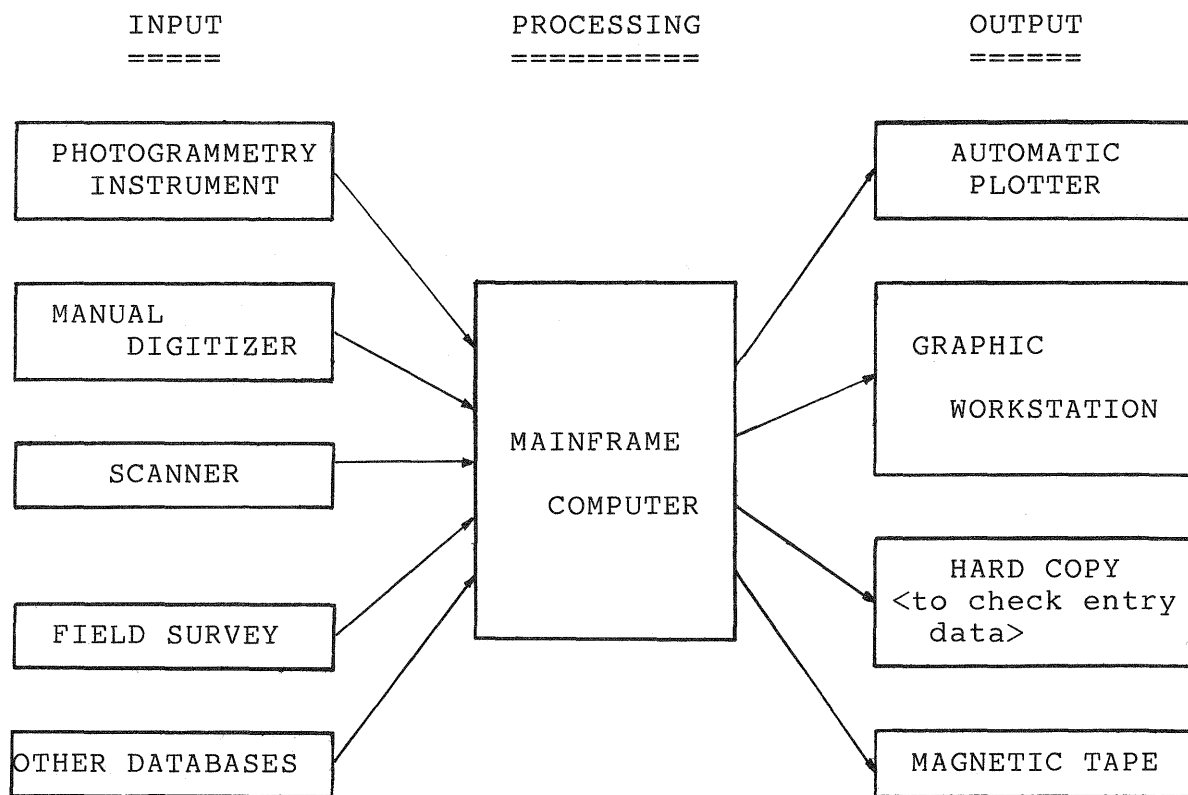| PHOTOGRAMMETRY INSTRUMENT | | AUTOMATIC PLOTTER |
| MANUAL DIGITIZER | | GRAPHIC WORKSTATION |
| SCANNER | MAINFRAME COMPUTER | |
| FIELD SURVEY | | HARD COPY <to check entry data> |
| OTHER DATABASES | | MAGNETIC TAPE |

Fig. 1 SYSTEM CONFIGURATION

--- W. H. CHEN ---
3 March 1988

Digital mapping uses computer to deal with the job of data
processing. As we mentioned above, a digital map includes a
large amounts of data in storage media like tapes and
diskettes. In order to facilitate this process, the host
computer should have the following characteristics:
-- sufficient memory for acceptable data processing speed.
-- fast processing
-- high reliability

## CONSTRUCTING THE SUITABLE DATABASE FOR DIGITAL MAPS

The database in mapping fields may be defined as a
systematical structure used in organizing data. The CMS
emphasis on both information extraction and data storage.
For flexible data manipulation, it contains GRAPHIC and
NON-GRAPHIC databases.

£ GRAPHIC DATABASE

Graphic database is used to store graphic data information for
further operation. In CMS, we construct the graphic database
for tour map by considering the following things:
* map scale
* types of features to store

Figure 2 is an example of graphic database structure.

** TOUR MAP IN TAIWAN AREA R.O.C.       SCALE:  1:1,400,000  **

```
                          TOUR MAP
                             |
    ┌────────────┬───────────┼───────────────────┐
 traffic       water      boundary        interesting place
    |            |                                |
  ┌──┴──┐      ┌──┴──┐    ┌──────┬──────┬──────┬──────┐
 rail  road  lake  river scenic  harbor  airport    others
 way                      spot
        |                    |       |        |
     ┌──┴──┐                hot    beach    light
  highway  coach           spring  resort   tower
```
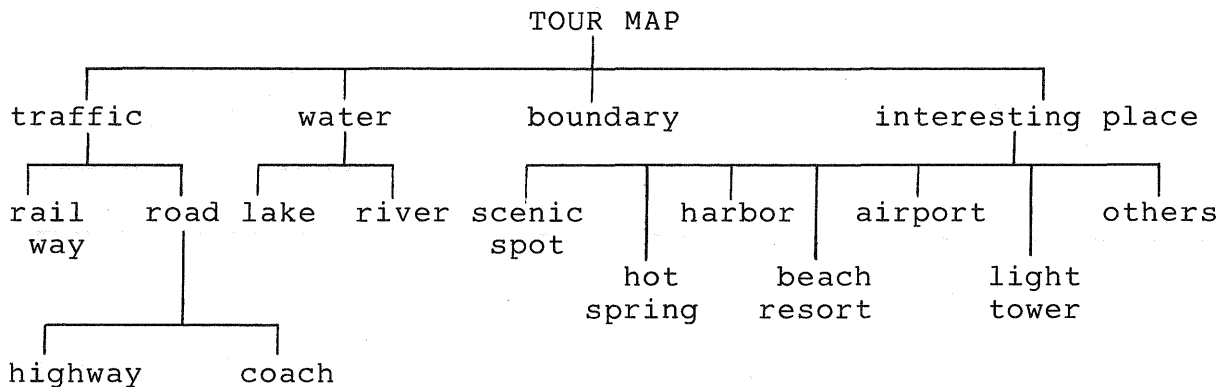
Fig. 2   SAMPLE OF GRAPHIC DATABASE STRUCTURE
                                        -- W. H. CHEN --
                                        4 March 1988

£ NON-GRAPHIC DATABASE

Non-graphic database is used to store non-graphic(attribute)
data in order to represent the part of reality that graphic
doesn't e.g. hotel information, interesting place information
etc.. In order to reduce the duplicate data in storage, we use
the concepts of the relational database as a rule to define
data field systematically. Both domain 1 and 2, shown on the
following, contain 2 different types of attribute data with a
same data field called city-name which is relatively
independent. When it is necessary to organize data field from

different domains in order to create a user's need domain. Then we can easily achieve it by using the concepts mentioned above. The domain we created is called "dummy domain" which share the existed data from both domain 1 and 2. For instance, to find out the scenic spots in city= TAIPEI and print out CITY_NAME, AREA, SCENIC SPOT NAME and ADDRESS. Then, we can easily achieve it by creating a dummy domain 3 to include the data field mentioned above in it with CITY_NAME(key field) equal to TAIPEI.

| CITY NAME<key> | AREA | .... |
|---|---|---|
| TAIPEI | : | : |
| TAICHUNG | : | : |
| KAOHSIUNG | : | : |
| CHIA-I | : | : |
| : | : | : |
| : | : | : |
| : | : | : |
| : | : | : |
| HUALIEN | : | : |

DOMAIN 1: CITY INFORMATION

| SCENIC SPOT NAME <key> | CITY NAME | ... | ADDRESS |
|---|---|---|---|
| AAAA | TAIPEI | : | : |
| BBBB | TAIPEI | : | : |
| CCCC | TAICHUNG | : | : |
| DDDD | TAIPEI | : | : |
| EEEE | TAIPEI | : | : |
| : | : | : | : |
| : | : | : | : |
| : | : | : | : |
| ZZZZ | KAOHSIUNG | : | : |

DOMAIN 2: SCENIC SPOT INFORMATION

After processing, the following data will be included into dummy domain 3:

| CITY NAME<key> | AREA | SCENIC SPOT NAME<key> | ADDRESS |
|---|---|---|---|
| TAIPEI | : | AAAA | : |
| TAIPEI | : | BBBB | : |
| TAIPEI | : | DDDD | : |
| TAIPEI | : | EEEE | : |

DUMMY DOMAIN 3: SCENIC SPOT INFORMATION IN TAIPEI

Some keywords are described as follows:
* key: an attribute used to located a record.

* attribute: the smallest unit of data that has meaning to user. (data item)

* record: a group of attributes; usually describing one type of item. ( a car, a road )

* domain: a group of records; usually describing a set of data with a finite set of attributes.

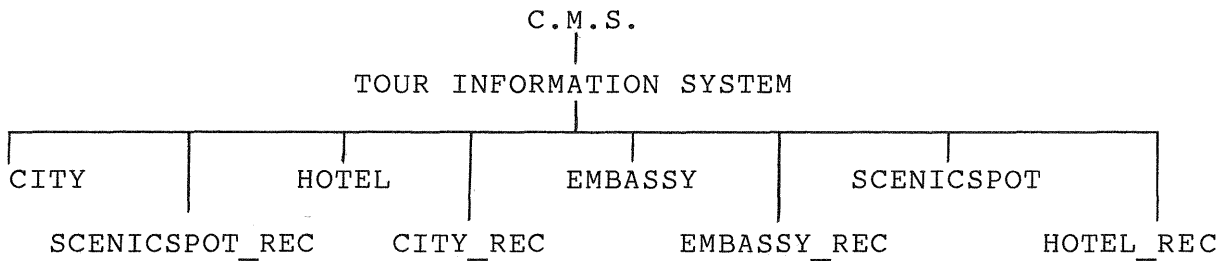The hierarchy of non-graphic data structure can be shown as follows:

```
                            C.M.S.
                              |
                  TOUR INFORMATION SYSTEM
                              |
  ┌──────────┬──────────┬─────┴─────┬──────────────┐
  │          │          │           │              │
CITY       HOTEL      EMBASSY    SCENICSPOT

   SCENICSPOT_REC    CITY_REC     EMBASSY_REC      HOTEL_REC
```

Fig. 3    HIERARCHICAL DATA STRUCTER FOR NON-GRAPHIC DATA

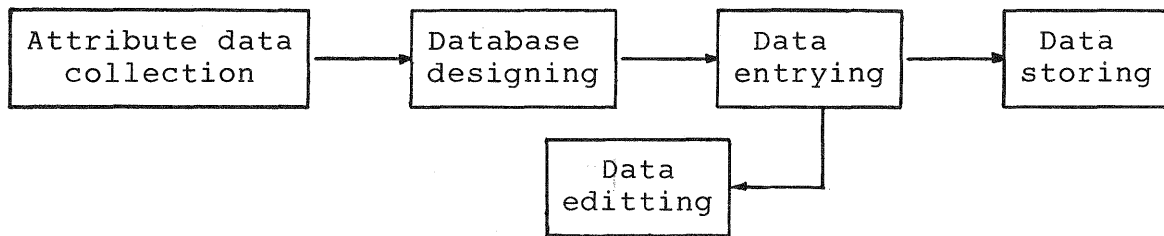<div align="right">

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4 March 1988

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## GRAPHIC INFORMATION ENTRY

In order to make the data  entrying  easier.   We  collect  the
equivalent layers in the same sheet shown as follows:
* blue color:  contains coast line , river, lake and reservoir
* black color:   contains  railway  network,  grid  system  and
                 anministrative boundary line
* brown color:  contain roads suitable for coach
* red color:  contains highway network

## NON-GRAPHIC INFORMATION ENTRY

In the part of non-graphic data entry,  system  flow  chart  is
shown as follows:

```
┌──────────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐
│Attribute data│──▶│Database  │──▶│  Data    │──▶│  Data    │
│  collection  │   │designing │   │ entrying │   │ storing  │
└──────────────┘   └──────────┘   └──────────┘   └──────────┘
                                        │
                           ┌──────────┐ │
                           │   Data   │◀┘
                           │ editting │
                           └──────────┘
```

### ASSOCIATION OF GRAPHICS AND NON-GRAPHICS INFORMATION

Two independent databases are only meaningful by  linking  both
together to produce interpreted information.  For instance:
-- find  the  location  of  object  according  to  the  existed
   attribute data
-- find the attribute data when user detect its real place

The CMS uses the so called "integrated  techniques"  to  handle
the work.  A briefly concept is shown behind.

```
┌──────────────┐     ┌──────────────┐     ┌──────────────┐
│  GRAPHIC     │◀───▶│  INTEGRATED  │◀───▶│ NON-GRAPHIC  │
│  DATABASE    │     │  TECHNIQUES  │     │  DATABASE    │
└──────────────┘     └──────┬───────┘     └──────────────┘
                            │
                            ▼
                     ┌──────────────┐
                     │    USERS     │
                     └──────────────┘
```
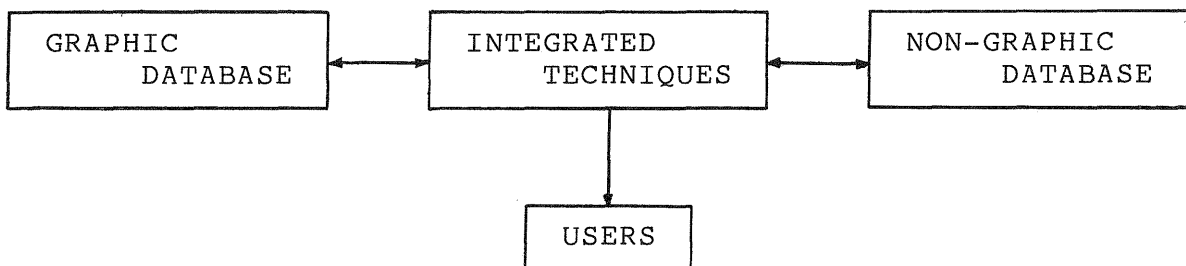
The integrated techniques cab be explained as a interface to link both graphic and non-graphic databases. The method includes the following things :

1.  define objects on graphics and give their meaningful identifier names e.g. cityname.

2.  write a linking procedure to implement the work. For instance, a procedure to list all scenic spots in a city and then, locate its city on graphics. The procedure should be simple and dynamic; easy to change.

3.  define objects and their attributes in the non-graphic database with object name as the identifiers similar to 1. Each object identifier is used as a **key** to match 1.

## APPLICATION OF GRAPHICS AND NON-GRAPHICS INFORMATION

The following result can easily show how computer - aided graphics techniques used in CMS tour map production. Appendix 1 is the final result from the printing plate which data resource is coming from the graphic database. The symbol (**object**), shown on the map was manual defined as a key in order to connect with it attribute data. By doing this, we create a set of procedure to handle this job with flexible searching criteria to suit user's application and data manipulation needs. The procedure include the following things:
1. ready both database in order to perform linking
2. find the object which you want to see its information
3. using user-written procedures to link them together
4. print the information on printer or screen

The CMS create a **menu** to suit people application e.g. data extraction. The menu can guide users to get the information which the system support. People can also handle it easily at any tour center or station around this Island.

## CONCLUSION

This paper simply shows how CMS introduced interactive graphics techniques in tour map production. The reason why we select this method is that it is easy for users to extract the information from both databases either seperately or simultaneously. The whole system is so far in the testing status. We are trying to enhance the system capability e.g. add more attribute data into non-graphic database etc.. Also, after testing complete, The data information will support to the tour center around this Island to suit the user's need. That is our way.

## ACKNOWLEDGEMENTS

# REFERENCE

[1] : Data management and retrival system(DMRS). INTERGRAF 1985.
[2] : VAV DATATRIVE Reference Manual December 1985.
[3] : VAX COMMON DATA DICTIONARY 1985.
[4] : S Y S S C A N map management.

LEGEND

⊕ Scenic Spot

⌐ Beach Resort

♨ Hot Spring

⚓ Harbor

✈ Airport

☼ Light Tower

卍 Temple

**TAIWAN STRAIT**

**PACIFIC OCEAN**

North Coastal Scenic Regions

N.E. Coastal Scenic Regions

Chungheng Highway Scenic Regions

East Coastal Scenic Regions

Lu Tao & Lan Yu Scenic Regions

Penghu Islands Scenic Regions

Kenting National Park

Pengchia Yu
Mienhua Yu
Huaping Yu
Fukuei Chiao
Paishawan
Chinshan
Tanshui Ho
Yangmingshan Park
Yehliu
Chiting
Chuwei
Chilung
Pitou Chiao
National Palace Museum
Taipei
Jufang
Chiang-kai-shek International Airport
Panchiao Taipei
Chihnan Temple
Tuung
Taoyuan
Pitan
Touchien Hsi
Nanliao
Wulai
Tzuhu
Kubishan Tao
Hsinchu
Safari Park
Shihmen Reservoir
Chaohsi
Kueiluan Tao
Chingtsaohu
Wufengchi
I-lan
Lanyang Hsi
Chiting
Lotung
Houlung Hsi
Shihtoushan
Meihua Hu
Suao
Miaoli
Mingte Reservoir
Tuchang
Taipingshan
Tunghsiao
Tapa Chienshan
Taon Hsi
Fayunssu
Fuhsing Shan
Weng Orchard
Tachia Hsi
Tiehchanshan
Chingshui Cliff
Shihkang Dam
Techi Reservoir Lishan
Wenshan
Taichung Harbor
Taichung (Fengyuan)
Tungshih
Hohuanshan
Tayuling
Tienhsiang
Taroko Gorge
Tatu Hsi
Taichung Park
Taichung
Kukuan
Hualien
Taiwan Provincial Assembly
Lushan
Changhua
Pakuashan
Huisun Forest Recreation Area
Wushe
Toulan Ruins
Lukang
Chunghsinghsintsun
Puli
The Geographical Center of Taiwan
Liyu Tan
Hualien Hsi
Choshui Hsi
Nantou
Jihyueh Tan
Fenglin
Hsilo Bridge
Sungpaikeng
Shuili
Hsilo
Chushan
Huwei
Yunlin (Touliu)
Hsitou
Tungluan Tashan
Santiaolun
Meishan
Tungpu
Chaotien Temple
Peikang
Ali Shan
Yu Shan
Hsiukuluan Hsi
Peikang Hsi
Chia
Tropic of Cancer Monument
Wufeng Temple
Yujir
Taitien Temple
Kuantzuling
Antung
Nankunshen
Tainan (Hsinying)
Tsengwen Reservoir
Kuan Shan
Pemen
Taoyuan
Kuan Shan
Chengkung
Sanhsientai
Hsiehchia
Wushantou Reservoir
Litao
Haituan
Tsengwen
Yuching
Peinan Chushan
Kuanshan
Anping Fort Zeelandia
Chihkanlou
Hutoupi
Old Castle
Tainan
Temple of Chengchengkung
Chishan
Huanhsi Shan
Akungtien Reservoir
Taitung
Fokuangshan
Chunchiuko
Chengchinghu
Santimen
Lu. Tao
Hsitzuwan
Pingtung (Fengshan)
Peitawu Shan
Kaohsiung
Kaohsiung (Fengshan)
Chihpen
Kaoping Hsi
Tungkang
Liuchiu Yu
Fangliao
Tawu
Lan Yu
Fangshan
Fengkang
Hsiaolan Yu
Ssuchunghsi
Hengchun Old Castle
Lungluan Tan
Kenting
Chialoshui
Maopitou
Oluanpi
Chihsingyen

Penghu Bay Bridge
The Spreading Banian
Penghu (Makung)
Tienhou Kung
Chimei Yu
Tomb of Seven Beauties

**DIGITAL TOUR MAP IN TAIWAN**