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Original Article

Creating a database model metadata GIS history of Kazakhstan

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ABSTRACT

In the article the problem of creation of information-reference subsystem of GIS on the history of Kazakhstan. To solve the problem, the author proposes new approaches reference to the map information stored in the database. It examines the binding database to the map using the geocoding, i.e., the fields and the creation of a unified classifier maps for all historical periods of medieval Kazakhstan.

KEYWORDS: History, Kazakhstan, Information

INTRODUCTION

The urgent problem of creation of the information database on a geographic information system on history of Kazakhstan of the medieval period is considered. On the basis of the constructed optimum model of interaction of compound GIS new approach of creation of such subsystem is offered. The example of program realization of this approach for a geographic information system of the scientific project No. 5060/GF4 "Creation of multimedia programs for training of history of Kazakhstan for geoinformation technology" is given. Development of history is connected first of all with continuous dynamic process of change of control over a certain territory. Changes of a situation in the history, on the one hand, are connected with such key events as wars, the contracts suddenly changing a situation on the card. On the other hand, there is a concept of a historical tendency when changes happen gradually, but in rather short period, for example, disintegration of world colonial system of 40-60 years of the last century. The created set of digital historical maps on history of Kazakhstan provides development of educational maintenance of courses of national history. For creation the training system on history of Kazakhstan geoinformation technology was used. At the same time the practical orientation of creation of geographic information systems (GIS) on history demands to create for each component of the historical period or process (the state, the city, the migratory directions etc.) individually that is, as a rule, connected with creation of separate specialized databases and the GIS electronic cards.

There is a need of assembly of thematic GIS of the card of the different making historical objects in uniform system for formation of a complex picture of historical processes.

Therefore, there is a problem of development of the database on history for creation of a directory subsystem of a geographic information system on history of Kazakhstan

Methods (methodology) of an experiment: For creation of a directory subsystem of GIS new approach which consists that on the basis of databases and cards of each thematic GIS the base of metadata (BMD) in the formalized look is formed is offered. The structure and the location of information on each object in a directory subsystem is determined by this base. The base of metadata (with Latin "metadata" – "data on data") contains information on structure and other features of data storage. For creation of model of base of metadata it is necessary to construct at first model of the system where these data are stored.

Let's enter designation:
$S = \{G\}$, (1)

which designates that the computer system of the historical periods of S consists of a set of specialized geographic information systems different historical information of G. For history of medieval Kazakhstan G has to contain historical information of the next periods:

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Казахстан в период раннего средневековья;

1. Kazakhstan in the period of the developed Middle Ages;
2. Kazakhstan in the period of the Mongolian gain and the Golden Horde;
3. Ak Orda, Blue Horde and Mogulistan;
4. Process of education and development of the Kazakh khanate (XV-XVII c.c.);
5. Kazakh and Dzungarian wars (XVII-XVIII c.c.).

Proceeding from (1) and the listed historical periods we have $S=\{G_1,G_2,G_3,G_4,G_5,G_6\}$, где G_i – historical information of the corresponding period.
Therefore the geographic information system of Gi can be presented combination of the Bi database and the electronic vector Mi card on the periods. In the formalized look this association can be presented in the form:

$G_i = [B_i \Leftrightarrow M_i]$, (2)

in which the sign«⇔»means that these Bi databases answer objects of the Mi card of a certain period.

Let's carry out formalization of interaction (1). As the model of interaction of databases and cards in GIS significantly depends on the software which at the same time is used, we will concentrate attention on the MS Access database management system and on geoinformation Panorama package.

All databases B = {Bi} can be united in MS Access as one computer *.mdb file it is characterized by the name of this NB file and stores a set of values of tables T:

B = [NB, {T}] (3)

Each of tables T has the name NT and is a set of fields, each of which has the name P, unique only for this table, and identical names of fields in different tables, type of data of D (numerical, text, date etc.) and the comment of R which is output to the user as the hint concerning data which are in this field are allowed.

T = [NT, {[P, D, R]}] (4)

The system of the organization of historical data allows to build thematic cards, to restore historical objects (the cities, roads etc.), to carry out information search and to carry out visualization of historical processes by means of IT technology.
Extent of specification historical information depends on a research of historical processes and its adaptation to IT technology.

1. The created thematic card on history of medieval Kazakhstan can be divided into three parts of dependence on contents of historical data: social and administrative, military military and political and card of cultural heritage. Structures of the database are provided by a possibility of input of the historical entire periods of information of history of medieval Kazakhstan. For example, in the table "Khan" the biography, the periods of board, historical portraits etc. register to the certain field of the database.
2. Historical subjects of the map it is possible to present in the form tables of the database the corresponding attributes:
3. the settlement (the name, dating, graphics, localization on card space, the description);
4. archaeological culture (the name, dating, graphics, localization on card space, the description);
5. petroglyph (name, dating, graphics, localization, description);
6. the place of burial (the name, dating, the graphic representation, localization on card space);
7. the city (the name, dating, the graphic representation, localization on card space, the description);
8. the capital (the name, dating, the graphic representation, localization on card space);
9. A rate of the khan or governor (the name, dating, the graphic representation, localization on card space);
10. A well (the name, dating, localization on card space);
11. A barrow (the name, dating, localization on card space, the graphic representation);
12. The mausoleum (the name, dating, localization on card space, the graphic representation);
13. A monument (any) culture or an era (the name, dating, localization on card space, graphic images);
14. An architectural monument (the name, the description, dating, localization on card space, the graphic representation);
15. The place of battle (the name of the place, dating, localization on card space, the description);
16. The place of a revolt (the name the place, dating, localization on card space, the description);
17. Ways of migrations (the direction, dating, localization on card space, the description);
18. Trade ways (the direction, dating, localization on card space, the description);
19. Means of communication (the direction, dating, localization on card space, the description);
20. Areas (any) actions (the name of events, processes, the phenomena, dating, localization on card space, the description), etc.

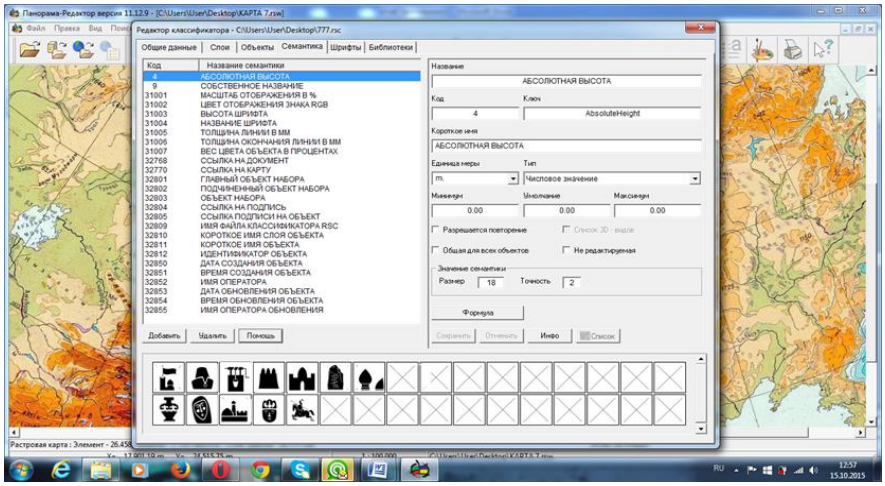


Fig 1. The card of the qualifier of thematic maps of medieval Kazakhstan in the Panorama editor cards

Basis of each card M in the Panorama GIS-package is the qualifier. The qualifier stores all set of objects K which can be displayed on the card (fig. 1). Thus, each card M in the Panorama GIS-package represents a set of objects K from the qualifier with the name NK:

Mi = [NK, {K}] (5)

Considering the above designations, we will construct model of interaction of databases and thematic cards of a geographic information system of history of Kazakhstan. For this purpose consistently we substitute models (2)-(5) in (1):

S = {G} = {[B ⇔ M]} = {[[NB, {T}] ⇔ M]} == {[[NB, {[NT, {P, D, R}]}] ⇔ [NK, {K}]]}. (6)

Where M={M1,M2,M3,M4,M5,M6}

To increase the functionality of information-reference subsystem of GIS should be taken into account in the model (4), respectively, and in model (6), setting b = {0, 1}, which takes only one of two values: b = "1" – field P should be displayed to the user of information-reference subsystem of GIS (e.g., display), b = "0" – field P does not show. Then the model (6) will be copied in the form:

S = { [[NB, {[NT, {P, D, R, b}]}] ⇔ [NK, {K}]] } (7)

Let's carry out optimization of model (7) by criterion of a minimum of quantity of elements of model, considering features of their use for an objective. First of all, proceeding from purpose of model (7), the parameter D (type of data of the field of the table of the database) in it is not necessary as it does not give useful information for base of metadata about an arrangement of data in system, to the user of a directory subsystem of historical data. Let's rewrite model (7) taking into account this remark:

S = {[[NB, {[NT, {P, R, b}]}] ⇔ [NK, {K}]]}. (8)

Let's create a set of tables of parameters A, each of which answers a certain table T, contains the P, R and b parameters of this table, and its name NA is formed by the rule:

NA = "HistoryKZ" + NT, (9)

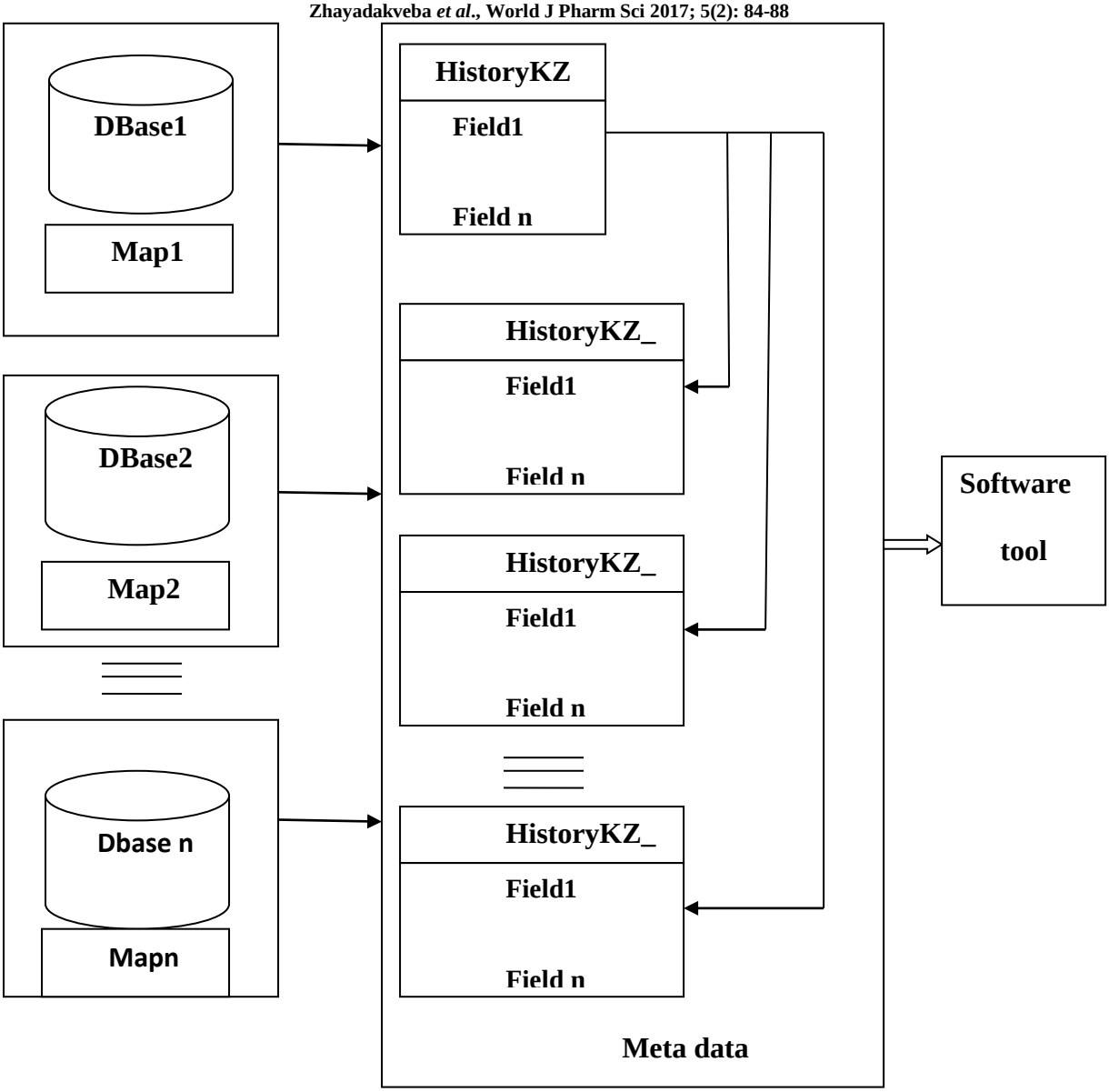
then the model takes place:

S = {[[NB, {A}] ⇔ [NK, {K}]]}. (10)

A = [NA, {P, R, b}]. (11)

As during computer realization the name of the file designates the file, that is in model A and NA have the same value, the following model takes place:

S = {[[NB, {NA}] ⇔ [NK, {K}]]}. (12)



The figure 2 Model of a directory subsystem of GIS on history Kazakhstan.

RESULT AND DISCUSSION

Simplification of model can be carried out if to construct all cards of system of the historical periods of S on the basis of the uniform qualifier. In that case it is not necessary to consider in model (12) the name of the NK qualifier – it one and therefore the model becomes simpler to such:

$S = \{[[NB, \{NA\}] \Leftrightarrow \{K\}]\}$. (13)

One more simplification can be made if to consider that a large number of cards on the basis of the uniform qualifier are actually one card. And in this case the ratio (2) is a compliance of records of a set of databases not to a large number of cards but only to one card to mean:

$S = [[NB, \{NA\}] \Leftrightarrow \{K\}]$, (14)

$A = [NA, \{P, R, b\}]$. (15)

Computer realization of models (13) and (14) in MS Access differs in the fact that the model (13) means a set of tables [[NB, {NA}] {K}], and (14) – only one such table. Thus, the base of metadata contains the main table (for example, under the name "HistoryKZ") constructed on model (14) which establishes compliance of objects K of the qualifier of the GIS cards to names of databases B and tables of parameters A of their tables. Also the base of metadata stores the corresponding tables of parameters A with data on fields of tables of databases B. the Model of base of metadata

constructed on the basis of model of system (14), (15) as a part of model of the GIS directory system is given in the figure 2 and table 1.

CONCLUSION

The developed approach provides such main advantages before other options of realization of a directory subsystem of GIS of history of medieval Kazakhstan:

1. Universality, speed and conveniences of addition of any specialized geographic information systems historical information and data.
2. A possibility of convenient management of structure of data which are output by directory system.

Table 1. Contents of the table HistoryKZ

CodeInGis	NameBD	NameTable
000001	Ancient_history_Kazakhstan	HistoryKZ_Petroglif
000002	Ancient_history_Kazakhstan	HistoryKZ_Kurgan
000003	Medieval history_ Kazakhstan	HistoryKZ_Khan
000004	Medieval history_ Kazakhstan	HistoryKZ_Town
000005	Medieval history_ Kazakhstan	HistoryKZ_Ulis
000006	Medieval history_ Kazakhstan	HistoryKZ_military cam
000007	New story_ Kazakhstan	HistoryKZ_ personality

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