

A 3S-based Construction of Northeast Village public Healthcare Sanitation Infrastructure in China: Frame and Key Technology

ZOU Bin, TONG Zhi-jun, LIU Xiang-nan

(College of City and Environment Science, Northeast Normal University, Changchun 130024)

Abstract The village public healthcare sanitation infrastructure is a strength guaranty of country productivity, it refers to the national security and stability. Now, the public healthcare sanitation infrastructure has been built in nation, province, city and county in China, but the construction of village public healthcare sanitation infrastructure is just under building. Thus, the frame and key technology of it need an in-depth study, especially, the Northeast Region of China where the economy is behindhand. In order to implement the healthcare sanitation information publicity and visualization, and combine the “3S” technology and characteristic of the Northeast Region, this paper proposes a 3S-based construction solution of the village public healthcare sanitation infrastructure, including the frame and the key technology. The frame of the northeast village public healthcare sanitation infrastructure is comprised of village foundation spatial database construction, village public healthcare sanitation database construction, computer knowledge-based system, village 3 dimension earth control network construction, village data exchange and transport network construction, national standard and rules of law. Similar to the frame, the key technology is comprised of data capturing technology, high-speed communication network technology, great capacity database technology, multimedia technology and artificial intelligent technology. With the guide of the frame and key technology, the other researchers are easy to make certain the direction in this field, the policy makers who work in the government and relational departments will make decision more correctly. Furthermore, it has great significance for impulsing the construction of village public healthcare sanitation infrastructure in nation wide, even the world's.

Key words: 3S, Northeast Region of China, Infrastructure, Healthcare

1. Introduction

Impulsing the development of the Northeast Region of China, manpower resource is the principal strength, it is the key factor to affect the prosperity and stability of the Northeast Region. Thus, studying the Northeast Region public healthcare sanitation status and insuring the Northeast Region manpower resource healthy and safe have the great significance. In today's public healthcare sanitation environment, the primary public healthcare sanitation infrastructures of nation, province, city and county have been built, the healthcare information system (HIS) of them have being built and modified as well. But the construction of the village public healthcare sanitation infrastructure is just beginning [1]. In the aspects of economy foundation, finance devotion, management of the public sanitation and entironment basic study, the northeast village of China is more laggard. It seriously blocked the real-time capturing, transporting, managing, analyzing, sharing and releasing of the public healthcare sanitation data In addition to this, it is also bad for policy makers to have the northeast village public healthcare sanitation status and

make correct decision. So, the study of how to build northeast village public healthcare sanitation information infrastructure in China is very important and necessary.

As the representative technology of globe spatial information technology, the “3S” technology has being applied in the field of medicine widely. The most important aspect is that the “3S” technology has become the major spatial visualization tools for medical data. So, it is valuable to build “a 3S-based Northeast village public healthcare sanitation information infrastructure in China”. The major roles of the “3S” technology for northeast village public healthcare sanitation are as follows. Globe position System (GPS) and Remote Sensing (RS) are the accessorial tools for capturing real time public healthcare sanitation data. Geographic information systems (GIS) provide healthcare information integration platforms (HIIP) for the convergence of healthcare information and their analyses in relation to population settlements, surrounding social and health services and the natural environment. They are highly suitable for analyzing epidemiological data, revealing trends and interrelationships that would be more difficult to discover in tabular format. Moreover, GIS allows policy makers to easily visualize problems in relation to existing healthcare and social services and the natural environment and so more effectively target resources.

2. Framework construction

On the basis of using “3S” technology fully, the great capacity for data storing and the artificial intelligence technology, the construction of a 3S-based northeast village public healthcare sanitation infrastructure changed the characteristic of traditional infrastructure which is only restricted to hardware and software environment construction, and emphasized on the spatial data infrastructure construction(SDI), the northeast village 3 dimension spatial earth control network construction, the public healthcare sanitation information sharing integration platform construction, as well as the public healthcare sanitation standard and the rules of law construction and so on .

Fig1 shows the framework of a 3S-based northeast village public healthcare sanitation infrastructure. According to the framework, the northeast village spatial database and northeast village public healthcare sanitation information database should be established and updated timely by using the infrastructure. The goal of it is to achieve the seamless integration between the geo-graphic information and the healthcare property information, display and analysis the status and the trend of public healthcare sanitation events directly, share and release the production by network, provide reference for various level policy makers, and thereby deal with public healthcare sanitation events effectively , it etc.

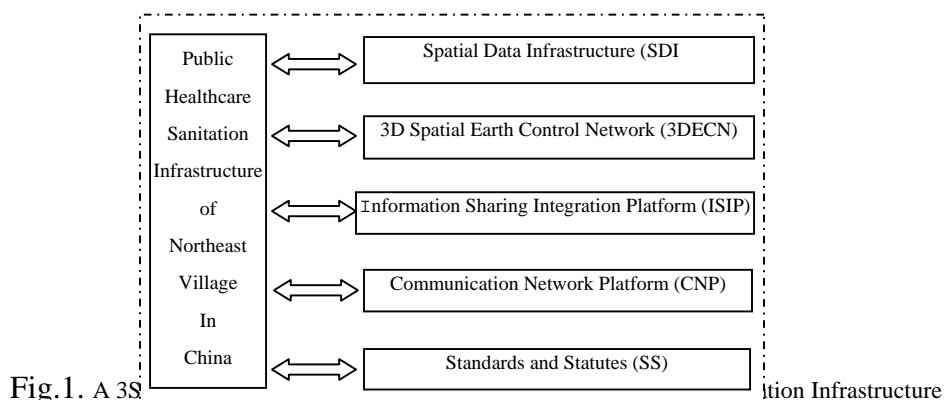
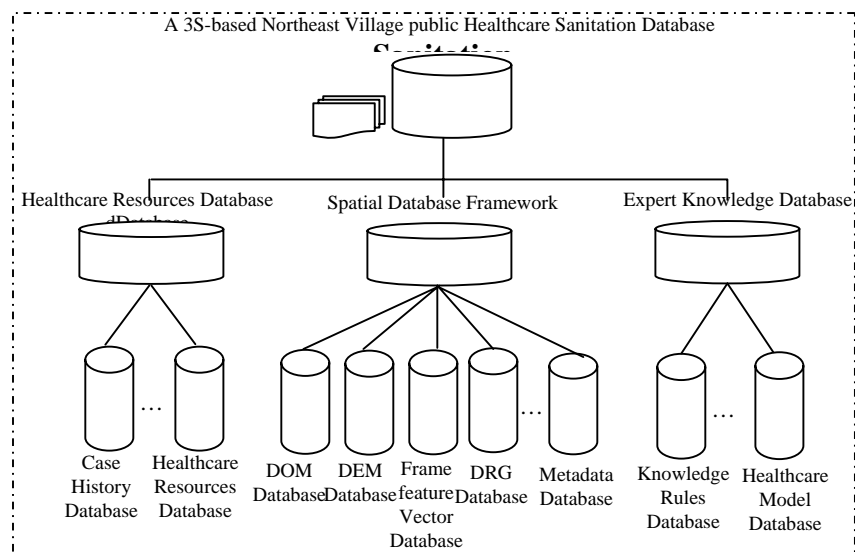


Fig.1. A 3S

tion Infrastructure

3. Database construction

The goal of the 3S-based northeast village public healthcare sanitation database construction is to build a series of data foundational framework system which is multiresource, multiscale, multikind, multiresolution in northeast village. Compared with traditional public healthcare sanitation database construction, a 3S-based Northeast village public healthcare sanitation database construction should be composed of the northeast village foundation spatial data framework construction, the public healthcare sanitation data framework construction and the computer expert knowledge base construction and so on. In the middle of the northeast village framework system construction, the northeast village foundational spatial database system construction is the public platform which provides common carrier for natural resource, environment and social economy, as well as the foundation of northeast village public healthcare sanitation information system. In the foundational spatial data framework construction, the foundational spatial database is the core. Although each independent database can play the respective roles in it, the function of integrated database is more powerful. Concretely, the foundational spatial database is composed of the digital orthophoto map database (DOMD), the digital elevation model database (DEMD), the framework feature vector database (FFVD), the digital raster map database (DRMD), the placename database (PD), the metadata database (MD), it etc. The public healthcare sanitation database should contain the northeast village case history database, healthcare resources database, it etc. The task of computer expert knowledge base construction is to transform the healthcare rules into knowledge by using artificial intelligence technology, and then build the healthcare model base. Fig2 shows the total framework construction of the database.



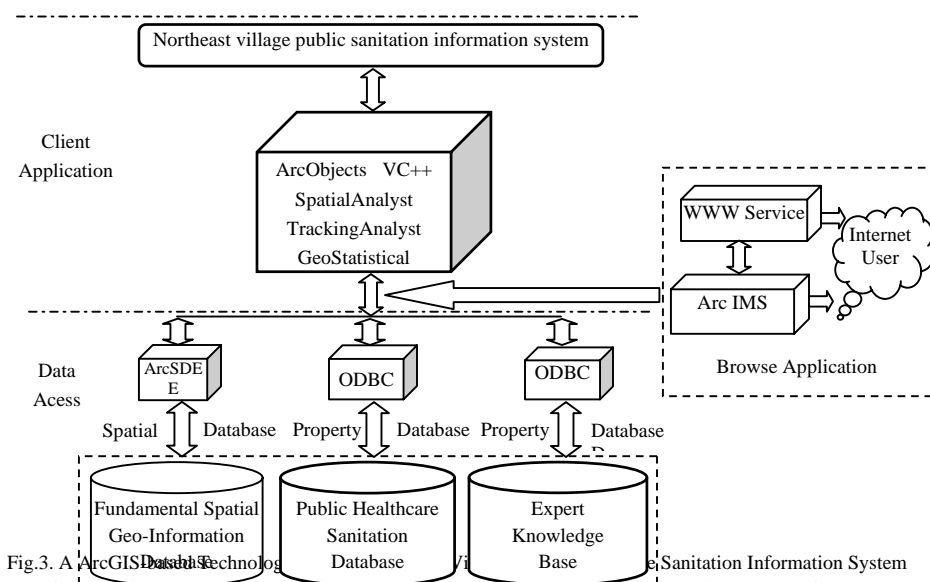
4. Public healthcare information sharing integration platform study

One of the targets of building northeast village public healthcare sanitation infrastructure is to realize northeast village public healthcare sanitation information sharing, analyzing, prealarming, and provide reasons for various level policy makers and reference for doctor or public. Thus, how to capture data and mine useful or necessary information or knowledge is not only part of the northeast village public healthcare sanitation infrastructure study, but also the key technology of solving northeast village

public healthcare sanitation problems. It is also the problem which is studied by northeast village public healthcare information integration platform.

4.1 Solutions for public healthcare information sharing integration platform

The solution for northeast village public healthcare sanitation information integration platform is the northeast village public healthcare sanitation information system. It is a healthcare information system which is to present and analyze medical data visually in spatial extent, as well as the web geography information system which is applied in northeast village healthcare sanitation field. Thus, in the process of the system building, the ArcGIS software which has the abundant and powerful function and Oracle DBMS that provides open connection and has the function of management graphic database are adopted. Fig3 shows the technology realizing of the northeast village public healthcare sanitation information system.



4.2 Function of public healthcare information sharing integration platform

The northeast village public healthcare sanitation information system is the northeast village public healthcare information sharing integration platform which is used to capture spatial information or medical information, integrate and fuse graphics information with property information seamlessly, as well as interoperation. The major functions of this system are as follows. Fig 4 shows the function of this system.

(1) Public healthcare sanitation information capturing and management

The task of public healthcare sanitation information capturing and management is to input the northeast village public healthcare sanitation historical data into system database, update it timely, and censor it to insure the reliability. Besides this, according to user's need, the system can provide relational data or reports output in time or correctly for users.

(2) Public healthcare sanitation information releasing and monitoring in spatial extent

One of the goals of the system is to realize the spatial visualization of medical data. In the system, the space releasing of public healthcare sanitation information is to graphicsize and visualize the northeast village public healthcare sanitation property

information on the northeast village basal electronic map. According to the relational history data, the historical healthcare property information can be interconnected with graphics information. With the globe positioning system, the new public healthcare sanitation information can be captured timely, or the location of events happening can be ascertained accurately on the northeast village electronic map by inputting the geo-coordinate of the happening place. On the basis of the visualization of the medical data in spatial extent, the elementary monitoring function of the system or the information sharing integration platform can be implemented by zooming in, zooming out, panning, finding and

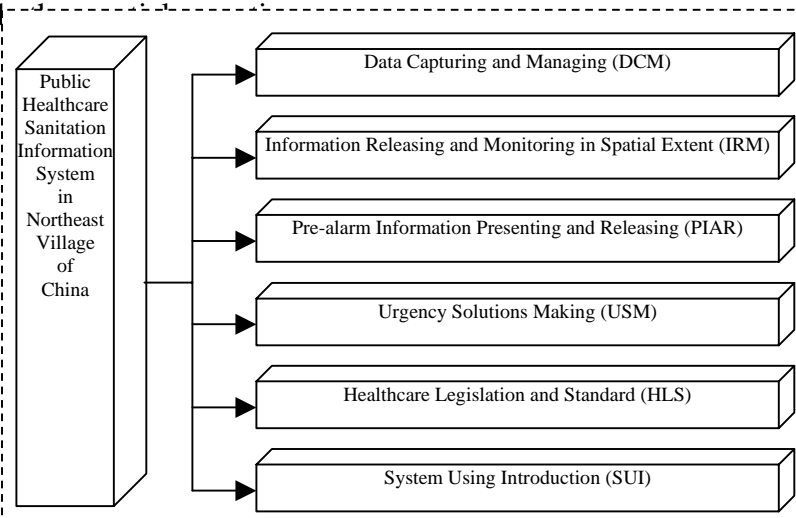


Fig.4. The Function of Northeast Village Public Healthcare Sanitation Information System

(3) Public healthcare sanitation pre-alarms information producing

After the northeast village public healthcare sanitation information releasing in spatial extent on northeast village electronic map, according to the user's need and spatial statistical cell, using the geo-statistical module, the system can implement the spatial statistical analysis of the northeast village public healthcare sanitation data. On the basis of the spatial statistical analysis, using the spatialanalyst module and trackinganalyst module of ArcGIS software, the system can emulate the development tendency of the public healthcare sanitation events which the users are interested in and perform the spatial risk dynamic analysis plotting in the aspect of time and space, thus reach the pre-alarms function.

(4) Urgent solutions studying out

The process of studying out the urgent solutions is the process to deal with the northeast village public healthcare sanitation urgent events. In order to insure the feasibility and validity of the urgent solutions that the system study out, the reasonable urgent model should be selected firstly according to the pre-alarms information that is the system produced and expert knowledge base; then, combing the distribution of public healthcare sanitation resources, the best scheduler should be implemented by using the selected model; finally, this urgent solutions should be emulated in computer, the system feasibility evaluation should be evaluated, as well as the system validity. Such and such repetition should be done until getting the reasonable solutions.

(5) A WebGIS-based northeast village public healthcare sanitation information sharing

Another function of this system is to release the northeast village public healthcare sanitation information by internet, and realize the northeast village public healthcare sanitation sharing. Thus, the system can provide the relational reference information for public and healthcare worker, as well as the authoritative scientific decision references for policy makers.

5. Network construction

As one aspect of the northeast village public healthcare sanitation infrastructure, network construction is the key to build the northeast village public healthcare sanitation information sharing integration platform. With it, the problems such as information transporting, resources sharing, information releasing can be solved timely. In the middle of it, the basic spatial data network exchange framework is the most important portion. It contains data production, data management, data distribution, it etc. At the same time, the repeated network construction should be avoided. With the gradually hugeness of healthcare information system, the traditional Client/Server network operation pattern is not apt to the user's need. In order to insure the validity of northeast village public healthcare information system, the structure of the northeast village public healthcare sanitation information network should adopt the Browse/Server pattern. In this network structure framework, no special application software should be set up on the client endpoint. With the explorer on the client endpoint, the user can visit any node in the northeast village public healthcare sanitation information system.

6. Conclusion and discussion

In the public healthcare sanitation information field, the hospital, clinique and other parts of the public healthcare sanitation department which are in the northeast village are regarded-self as independent entity. All the medical information are closed or strict to share in the intranet. The relational medical department is lack of communication with outside. Thus, the value of the information become smaller, the releasing, monitoring, pre-alarmed of the northeast village public healthcare sanitation events are limited. In the end, it will affect the correct decision which is maken by the relational government. With the construction of the northeast village public healthcare sanitation infrastructure and northeast village public healthcare sanitation information sharing integration platform, the healthcare sanitation data can be visualized in geo-spatial extent, the northeast village public healthcare sanitation information can be distributed, monitored and pre-alarmed in geo-space. In the end, the emulation solutions to solve the northeast village public healthcare sanitation events will be brought forward timely and correctly. As a hugely distributed healthcare sanitation information system which is oriented towards the internet, the database design, the network framework and the system architecture e need an in-depth study.

References

- [1] Wang Xin, Ben-Xin Wang, The "SARS" revelation in sanitation system and national information management, *advices sience*, 2003,21:1276-1279.
- [2] Steven Riley, Christophe Fraser, Christl A. Donnelly, et al. Transmission Dynamics of the Etiological Agent of SARS in Hong Kong:Impact of Public Health Interventions, *Science*, [ww.sciencexpress.org/23 May 2003/](http://www.sciencexpress.org/23%20May%202003/) Page 5/10. 1126/science. 1086478, 2003.

- [3] S. Y. Yan, L. Zeng, F. Xu, et al. Network for Resource, Environment and Regional Economy Distributed Information Sharing and Applications[M]. OceanPress, 2002,7,1—230.
- [4] Fabrizio, Massimo, Ferrara. The standard 'Healthcare Information Systems Architecture' and the DHE middleware. International Journal of medical informatics, 1998, 52:39-51.
- [5] Oracle 8i document library, Oracle Co.
- [6] Rohan Jayasuriya. Managing Information Systems for Health Services in a Developing Country: a case study using a contextuallist frame work. International Journal of Infromation Management, 1999, 19:335-349.