Homestead Engineering Planning Based on CAD Internet of Things Technology

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Abstract. System integration has created a homestead planning management system employing CAD Internet of Things technology to achieve the goal of merging constantly increasing computer technology with the information management of homestead planning. Rural homestead management is the most fundamental and fundamental aspect of land management. Its logical planning and scientific management are inextricably linked to land, particularly the usage and conservation of cultivated land resources, as well as the development of farmer productivity and quality of life. As a result, the author undertakes secondary development based on the MapGIS K9 platform software in order to save and scientifically manage the aforesaid data in an orderly manner. Investigate and implement a homestead planning and management system that incorporates GIS and OA technologies. A number of functional modules are constructed and the system is built utilizing the homestead planning information management presented in this work, based on an in-depth examination of the management demands of rural homestead use rights. According to the survey data, the total land area of a certain land is 143,334.82 hectares, including 119,330.59 hectares of agricultural land, 20,976.04 hectares of construction land, and 3,028.19 hectares of forest land. Collective construction land (village and mining land) accounts for 60.21 percent of all construction land, with a total area of 12,628.84 hectares. In certain townships and rural regions, the total quantity of communal construction land is 5969.76 hectares, accounting for 71.15 percent of all building land. Industrial storage and commercial land (3.72 percent), rural mining land (1.05 percent), public service and infrastructure land (0.83 percent), rural residential property (94.33 percent), mixed land (0.35 percent), and other construction land are the six groups studied (0.07 percent).

Keywords: Homestead; Internet of things technology; CAD; Land ownership.
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1 INTRODUCTION

With the continuous improvement of China's economic structure system, in the modern trade behavior, commodity exchange attaches great importance to the authenticity of information transmission. Therefore, to meet the information transfer between people, people's innovation in science and technology, the Internet of Things technology appears in people's world. This technology changes the application of traditional Internet technology, the Internet of Things technology not only enriches people's spiritual world, but also meets the development needs of society. The Internet of Things technology uses a variety of network technologies, which means that many things are linked together to form the Internet of Things. The Internet of Things technology involves a very wide range, using a variety of computer equipment mainly with network communication technology as the main core, coordinate the various parts, combining multiple parts of work to effectively realize the exchange of information technology and work among various departments. The main advantage of using the Internet of Things technology in electronic equipment is that it can effectively manage items, and it can also use the management between people and things. In the management information system of rural homestead use rights, the Internet of Things also has an important application, to a certain extent; it can realize the exchange and transmission of information and improve work efficiency [1].

In addition, in land planning research, it is often necessary to calculate the area of land acquisition, at this time, if the land to be acquired is determined, various methods of measuring land can be used to calculate, but the general situation is: There are many places to choose from, and the price of land varies from place to place, and the ground is generally not completely flat. At this time, if the actual measurement is used, the workload is large and unnecessary [2]. Given the numerous environmental and social challenges that have arisen as a result of global urbanization in recent decades, sustainable land use planning is critical for steering future progress toward a sustainable society [3, 4].

Beginning with the concept of spatial optimization, the approaches has been made sustainable land use planning, as well as reviewing temporal optimization methodologies for addressing challenges in sustainable land development, such as objectives, formulation, and solutions [5, 6]. As a result, it's critical to employ CAD technology to calculate the land acquisition area in land planning, which may be used for the primary selection of various rural homestead planning research programs and has a limited application range. From battling climate change to revolutionizing emergency response systems, the Internet of Things is beginning to find a home in many more facets of our life. Although the Internet of Things is still in its infancy, it is already being implemented into a wide range of goods and services that have been built to make people's lives simpler. Despite its widespread use and expansion, the Internet of Things continues to face challenges that must be addressed. These include technological concerns, corporate obstacles, and societal challenges. These are the primary challenges that IoT faces. These three issues cover a wide range of topics.

The Internet of Things technology encompasses a wide range of applications, utilizing a variety of computer equipment primarily with network communication technology as the central component, coordinating the different parts, and combining multiple parts of work to effectively realize the exchange of information technology and work among various departments. The primary benefit of incorporating Internet of Things technology into electrical equipment is that it can successfully manage products as well as people and things. A rural homestead is collectively held land that is occupied and utilized as a residential basis by rural households or individuals [7]. Every structure relies on building management systems. Residents can utilize these technologies to monitor and control the day-to-day operations and activities of the building [8, 9]. Building department systems were inventive in their early days, altering the way building operations were carried out. A computer-based control and management system might handle the operational features of a building autonomously [10, 11]. Building managers were able to do their tasks more effectively as a result of this.

The Internet of Things has the potential to help every aspect of management Company. The main advantage of integrating IoT for building management systems is its low cost. IoT devices save money not just during deployment but also during continuous maintenance [12, 13]. In practice, land usage, operation, and management have a direct impact on production and economic growth, with rural homestead management being at the forefront and most fundamental of land management tasks. Its rational planning and scientific management are directly related to the utilization and protection of land, especially cultivated land resources, and the improvement of farmers' production and living standards. The right to use homestead is based on the maintenance of collective land ownership, a kind of usufruct created to facilitate the construction of houses by farmers (see Figure 1). Land management has a direct impact on production and economic growth, and managing rural homesteads is the most basic and fundamental task in land management. The spatial location, the construction of a homestead use right management system, and the administration of rural homestead cadastral ownership, location, boundary point, and boundary line are all intimately connected to the spatial location.

Although national laws and regulations have always clearly stipulated that the open circulation of rural homesteads is prohibited, with the rapid development of my country's economy and the acceleration of urbanization, the flow speed of the rural population and the income of the rural population also increase, so the circulation phenomenon of the treasure base. Especially in economically developed areas and urban-rural junctions, it has become very common, and civil disputes in the process of these transfers have become increasingly serious. Therefore, rational and scientific management of the right to use rural homestead is of great practical significance for stabilizing rural social order and improving farmers' living standards [14-15].

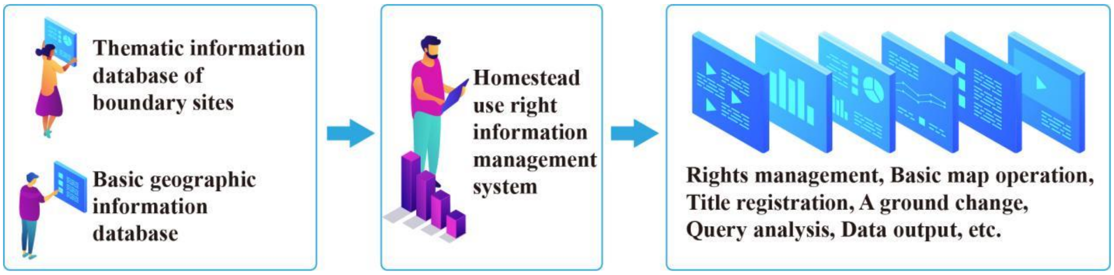

Figure 1: Homestead engineering planning system based on CAD Internet of Things technology.

Rural homestead management is the forefront and most basic work of land management. Its rational planning and scientific management are directly related to land, especially the utilization and protection of cultivated land resources, and the improvement of farmers' production and life. The management of the right to use rural homesteads is an important part of the construction of state power, during the actual boundary demarcation process, a large number of important materials such as graphics, texts, tables and photos have been formed, these materials are of various types and are intricately related.

The remainder of this paper is organized as follows: section 2 presents a literature evaluation of the Geographic Information System (GIS) and homestead engineering planning. The research methodologies are presented in section 3, and the results are analyzed in section 4. Section 5 contains concluding remarks as well as future research directions for the research effort described in this article.

2 LITERATURE REVIEW

With the rapid development of knowledge and science and technology, we have entered the era of digital information, with the introduction of "Digital China", information systems based on GIS technology have been established one by one. Geographic Information System (GIS) is an information system established by combining geography and cartography, as well as remote sensing and computer science. A geographic information system is a computer program that captures, stores, checks, and displays data about locations on the Earth's surface. GIS may help individuals and organizations better comprehend geographical patterns and relationships by connecting apparently unconnected data. People may use GIS technology to compare the positions of various objects to see how they connect to one another.

The application of geographic information system technology will considerably increase parcel boundary line survey and management job efficiency, as well as offer a timely scientific basis for management department decision-making. It can realize the collection, integrated processing, storage management, query analysis, efficient visualization and mapping of basic geographic information and various thematic information related to geospatial data through computer technology, at present, it has been widely used in different fields.

GIS may combine the particular display and spatial analytic capabilities of maps with conventional database operations as a full field. The establishment of a homestead use right management system is based on the geographic information system, supplemented by remote sensing (RS), global positioning system (GPS), and other high-tech to standardize the management of rural homestead cadastral ownership, location, boundary point, and boundary line is directly related to the spatial location. Standardize and digitize the results data formed in the work of the industry, establish a homestead gallery, a boundary line and boundary location database, a land ownership register, and a document database and spatial database of related written materials, and establish a dynamic update mechanism, so as to provide efficient and fast means for the management of the parcel boundary and the development and utilization of the boundary results. The use of geographic information system technology will greatly improve the work efficiency of parcel boundary line survey and management, provide timely scientific basis for management department decision-making, and lay a foundation for the informatization of homestead use rights management [16-17].

Amirebrahimi et al. [18] advocated adopting a data model to integrate BIM with GIS. Liu Xin et al. [19] investigated the BIM and GIS integration solution and developed a data model for BIM and GIS integration. Through the SUPERMAP secondary development platform of BIM model and the integration of GIS, the primary interface of the system in the platform, Guo Ruiyang [20] BIM model is researched and the fusion of 3 dgis technology research and implementation. Zhang Wensheng [21] et al. investigated BIM and 3DGIS integration technology and its application in railway bridge building. The entire process of integrating BIM and 3DGIS technology is discussed in depth, and the technology is used to the construction of railway bridges in practice.

Cheng Fangyuan et al. [22] investigated the study and application of integrated GIS/BIM digital management of highway tunnels, and via the infrastructure Smart Service, they realized the technological integration of GS-BIM and its application in tunnel engineering. BIM provides detailed information about buildings and infrastructure assets. The BIM process creates the integrated database(s) of an asset, which includes a 3D digital representation of the asset's physical and functional qualities, as well as rich linguistic data on linked components/objects [23, 24]. It is a collaborative information resource that aids in the administration of documents, communication, and simulation. BIM provides a robust foundation for project teams to make decisions throughout the project life cycle [25, 26]. GIS provides data on such assets in connection to their natural and built environments, as well as some other significant factors such as demographic, socioeconomic, and environmental concerns [27, 28]. Irizarry et al. [29] created an integrated GIS-BIM model that depicts material flow, resource availability, and the visual presentation of building supply chain status.

Through the construction of the rural homestead use right management information system, it can effectively manage the ownership area, location and other information of the rural homestead, which has the following important significance:

1) Effectively preserve and utilize the results of demarcation, and improve the modernization level of rural homestead management.
2) Provide scientific basis for the government to correctly handle civil disputes.
3) An integral part of the digitalization of administrative management.

Land is the basis for farmers to live on, and the use and management of land directly affect production and economic development. As one of the commonly used social public information, homestead boundary is not only closely related to farmers' daily life, but also an indispensable basic information resource for rural administration, land development and utilization, and rural economic construction. As an important part of basic geographic information, parcel boundary is an essential element in the construction of digital China and digital government [30].

In the research on the right to use homestead, there is almost no land transfer phenomenon, mainly because the land in most countries is privately owned and the early implementation of the market economic system. As long as the title is clear, residents can buy, sell, lease or mortgage land. In terms of land management, some developed countries have established land information registration and query systems based on technologies such as the Internet/Internet of Things (Internet/Intranet) [31]. As early as 1983, Germany entered the data containing all the land registration information processed by the states according to the unified requirements into the automated land database, the public can inquire and retrieve the accurate and time-sensitive land registration materials in the data table through man-machine dialogue [32].

In 1998, the Greek government launched the "Ancient Greek Cadastral" project, using advanced information technology to build a client/server-based network system, it allows Greek citizens to query land information conveniently and quickly without violating personal privacy, and the maintenance cost of the database is low [33]. The Finnish National Land Survey started digitizing attribute data in cadastral registers in the late 1970s. In the mid-1980s, MapGIS software was used to optimize and update the map data in the cadastral index map, and then because the attribute data and map data were stored in different systems, the error rate was greatly increased and the system maintenance cost was too high. , and use Small World GIS software as the development tool of the new system (JAKO) [34]. The attribute data and map data are stored in the same seamless relational database at the same time, which improves the efficiency of data collection and update. The Netherlands began to adopt digital land registration for more than 7.5 million land parcels nationwide in 1990, and completed the digitization of the national cadastral map in 1999, it also provides information query services based on terminal emulation technology in the WEB environment, and began to implement the "online cadastral" project in 2001 to better meet users' growing needs for land information.

Farmers' livelihoods are dependent on land, and land usage and management have a direct impact on output and economic growth. Homestead border, as one of the most widely utilized social public information, is not only directly linked to farmers' everyday lives, but also an essential fundamental information resource for rural administration. Attribute and map data are kept in the same seamless relational database at the same time, making data collection and updating more efficient.

3 RESEARCH METHODS

3.1 Demand Analysis of Homestead Planning Management System

The homestead planning management system, as a part of the homestead use right and collective land ownership information management system, is mainly used by the land registration department and management department, so the system is required to be simple to operate and easy to use. The requirements analysis mainly focuses on three aspects: User, function and performance, the functional requirements are shown in Figure 2.

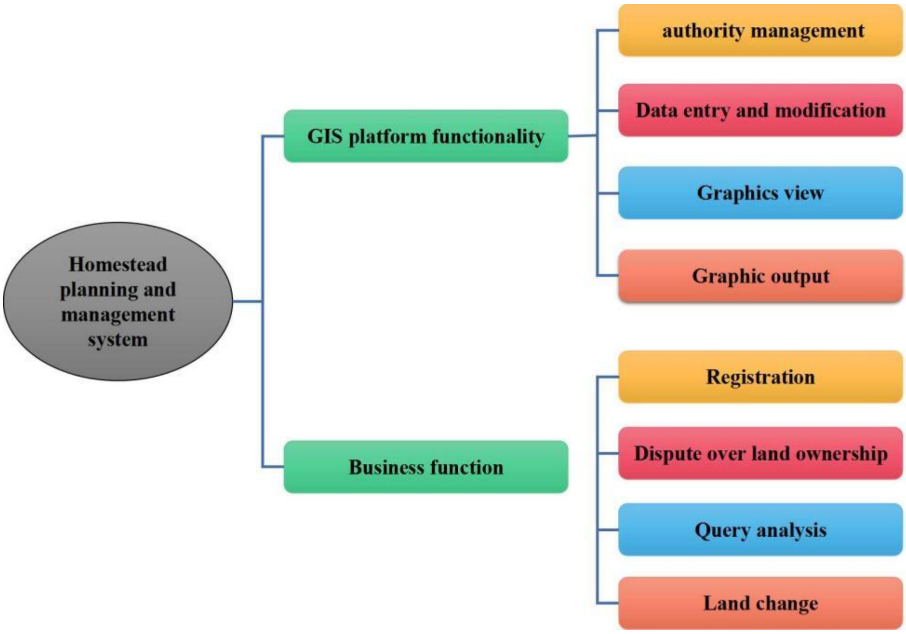

Figure 2: Functional requirements of homestead planning information management system.

3.1.1 *User analysis*

Users are mainly the land registration management department and decision-making department of the Land and Resources Bureau, who can obtain various data and information of land ownership through this system, according to the different needs of each department, the system gives users different permissions. The land registration management department is responsible for backing up, restoring, updating and maintaining homestead data and information, that is, it needs to manage the background database. Its users can be divided into administrators and data operators. The administrative user is responsible for managing the rights of the user and managing the data in the database. Data operators perform routine maintenance and modification work such as data entry and update according to their own authority, and ensure the correctness, integrity and consistency of the data. The decision-making department mainly conducts operations such as browsing, querying and analyzing land ownership information through the local area network.

3.1.2 *Functional analysis*

The system needs to provide resource management of spatial data and non-spatial data in a confidential environment, and requires the integration and integrated management of existing homestead vector data, raster data, image data and electronic documents and other information; It can perform necessary changes and edits such as adding, deleting, and moving the parcel boundary address information in the database, and simultaneously realizes the synchronous storage of historical data and current data: According to the needs of the work, it can provide various ways to query the data of the parcel boundary, the topographic map corresponding to the boundary, the boundary address, the text and the chart, and perform information extraction and statistical analysis; Meet the needs of map printout. Various devices can be configured to output graphics, text and reports according to the actual needs of users.

3.1.3 Performance analysis

It can be known through user analysis and functional analysis. Users need to ensure the security of database data. In order to prevent malicious tampering or data loss due to hardware failure, the stability of the system is very important. Due to the small amount of data in this system, the requirements for computer hardware facilities are not high. Operation is relatively stable. But it is worth noting that the database needs to be backed up regularly. In addition, in order to improve work efficiency and reduce the user's adaptation time to the new system, the system design should favor simple and convenient operation.

3.2 Features of Homestead Planning and Management System

The daily management of homestead planning includes the management and updating of a large number of terrain data, documents, pictures and other multimedia data. Therefore, it is similar to a general geographic information management system and must have the following characteristics:

3.2.1 Security and stability

The system has designed a large number of vectors and raster terrain data, document pictures and other multimedia materials, these materials are obtained through field measurements and investigations by field personnel, and most of them are classified data. There are extremely high requirements for the security, confidentiality and stability of the system.

3.2.2 Unified management of multiple data formats

Since the system includes remote sensing image data in different formats, raster terrain data, and old media data such as documents and pictures, the amount of data is large and the types and formats are different, so it is necessary to establish an update mechanism for these data, so as to achieve efficient development and utilization of homestead use rights and demarcation results.

3.2.3 Standardization and normalization

The rural homestead management system integrates high and new technologies such as electronic computer technology, database technology, and geographic information system technology, effectively manage the results and data formed in the demarcation work, databases and information management systems must be standardized and standardized in accordance with and with reference to relevant national standards.

3.2.4 Multiple scales

Homestead information management needs to provide multi-system library support, vector data of different scales can be displayed by referring to different system libraries, data with different scales of 1:20001:1000, 1:500 and 1200 can be displayed conveniently and flexibly.

3.2.5 Historical data management

In the management of the right to use the rural homestead, it is often necessary to refer to the historical data of the edge of the parcel, analyze changes in edge position, and assist in resolving some disputes over land ownership. Therefore, homestead information management needs the function of retrospection the state at a certain moment in the past according to historical data, and can carry out dynamic evolution of historical change.

3.3 Data Analysis

3.3.1 Text data

According to the actual research situation, the texts that need to be collected and generated during the research process can be mainly divided into four categories, including reference copy, implementation plan, surveying and mapping technical documents, and surveying and demarcation results. Relationships by their classification, content, and business flow are shown in Figure 3.

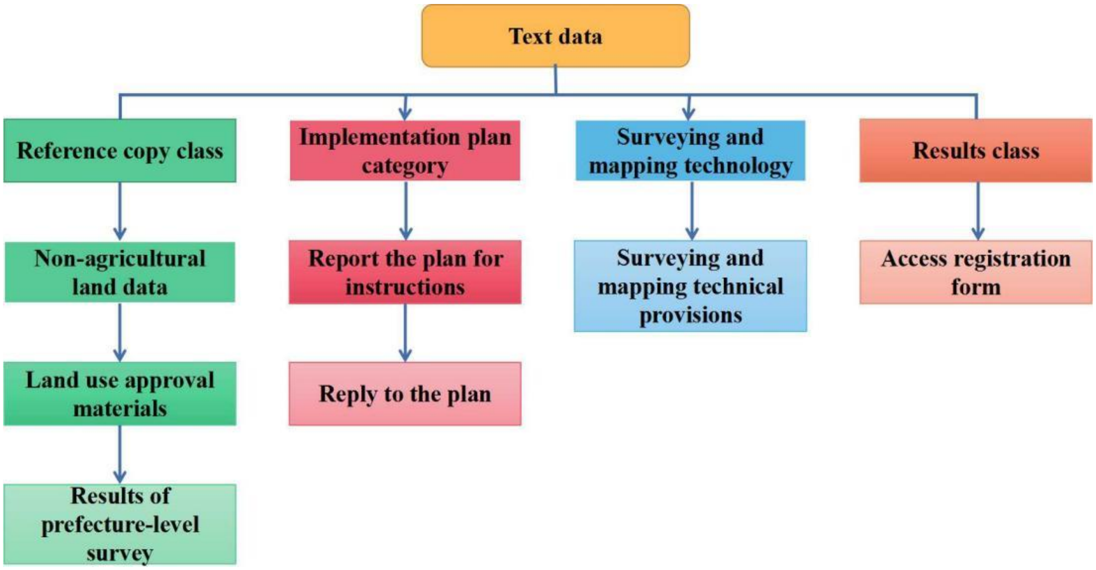

Figure 3: The relationship between text data classification, content and business flow.

3.3.2 Boundary point information

The investigation working group and cooperating units of the right to use homestead and construction land, jointly make overall arrangements for the progress of townships and the division of cadastral areas and cadastral sub-areas. Before conducting the ownership survey, it is necessary to determine the area delimited by the cadastral area boundary and the cadastral sub-area, as well as the cadastral area boundary and the cadastral area number, so as to avoid repeated cadastral survey numbers and empty windows in the survey area. The topographic map data is the digital ortho-photo image base map obtained after approval, and the 1:1000 cadastral map of the survey of the right to use the homestead and the right to use the construction land. The image base map is managed in the system as electronic archive data. The cadastral map and planning map vector data use the compiled boundary demarcation detailed atlas data, and the cadastral sub-areas are stitched together and then managed.

3.4 Entity-Oriented Data Model

Entity-oriented data model, it is a conceptual data model established for database users that is not constrained by any database management system. The E-R model (Entity-Relationship Approach), the entity-relationship method model, is widely used in the design of the conceptual structure of the system database. The E-R model is composed of entity set, attribute and relationship set, and the representation method is shown in formula (3.1):
A basic E-R model:

$$S = (L_s,\ attrs\ _s, role_s, pk_s) \tag{3.1}$$

Among them: L_s, attrs $_s$// $role_s$, pk_s are the dictionary, attribute function, role function and primary key function defined by E-R respectively, the specific expression is shown in formula (3.2):

$$Ls = (E_s, R_s, D_s, A_s, U_s) \tag{3.2}$$

In the formula: E_s represents the entity set symbol set; R_s is the contact set symbol set; D_s represents the resin set symbol set; A_s is the attribute set symbol set; U_s represents the role set symbol set. Then as shown in formula (3.3):

$$attr_s(x) = [A_1: D_{1,} \cdots, A_h: D_h] \tag{3.3}$$

Among them: $attr_s(x)$ is the attribute function, the definition domain is $E_s(\,)R_s$, and the function value is a tuple of A_s tags on D_s. And formula (3.4) is:

$$role_s(x) = [U_1: E_1, \cdots, U_z: E_z] \quad (3.4)$$

In the formula: $role_s(x)$ is the role function, the definition domain is R_s, and the function value is a U_s tag tuple on E_s. Then as formula (3.5):

$$\mathrm{pk_s(x)} = [\mathrm{A}'_1: \mathrm{D}'_1, \cdots \mathrm{A}'_k: \mathrm{D}'_i] \quad (3.5)$$

Among them: $pk_s(x)$ is the primary key function, the definition domain is E_s, and the function value is an As-labeled tuple on D_s, for $\forall \mathrm{E} \in E_s$, any pair in $pk_s(E)$ is in $attr_s(E)$.

3.5 The Overall Architecture and Composition of the System

In order to meet the functional requirements of data input, editing, updating, query, spatial analysis, extraction, exchange, backup and recovery, etc., the main task of establishing a geographic information system is to build an efficient database management system [35]. While realizing the management and scheduling of the database, it can provide a variety of query and retrieval methods to meet the requirements of data query and analysis.

Based on the analysis of the current management needs of rural homestead use rights, the author, research and establish an information management system, use 3S space information technology and combine computer technology, database technology, multimedia technology, etc. to standardize the result data, in the process of standardization and digitization, the establishment of spatial databases such as the special database of parcels, the database of boundary sites, the registration book and the document database of related documents, it also associates attribute data with spatial data to provide scientific, efficient and fast means for homestead management, achievement data, and boundary demarcation [36]. The structure diagram of the homestead planning information management system is shown in Figure 4.

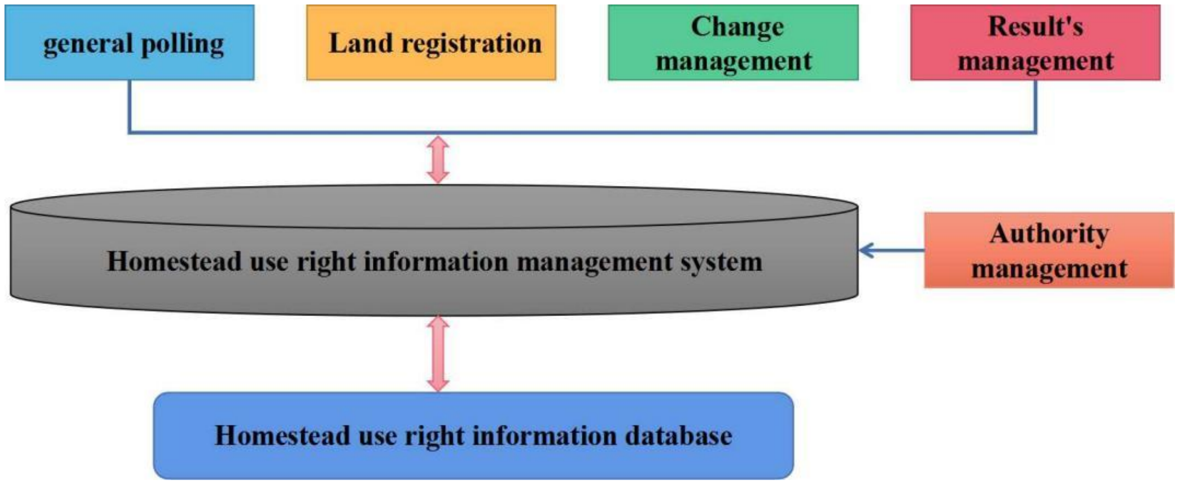

Figure 4: Overall system architecture.

3.6 Database Structure

The database of the system consists of five parts: digital grid map database, digital line map database, parcel boundary and boundary location database, boundary demarcation text data database, and metadata database [37]. The data are all stored in the Oracle database, and the spatial data is managed by the MapGIS K9 spatial database engine, the structure diagram of the homestead planning right information database is shown in Figure 5.

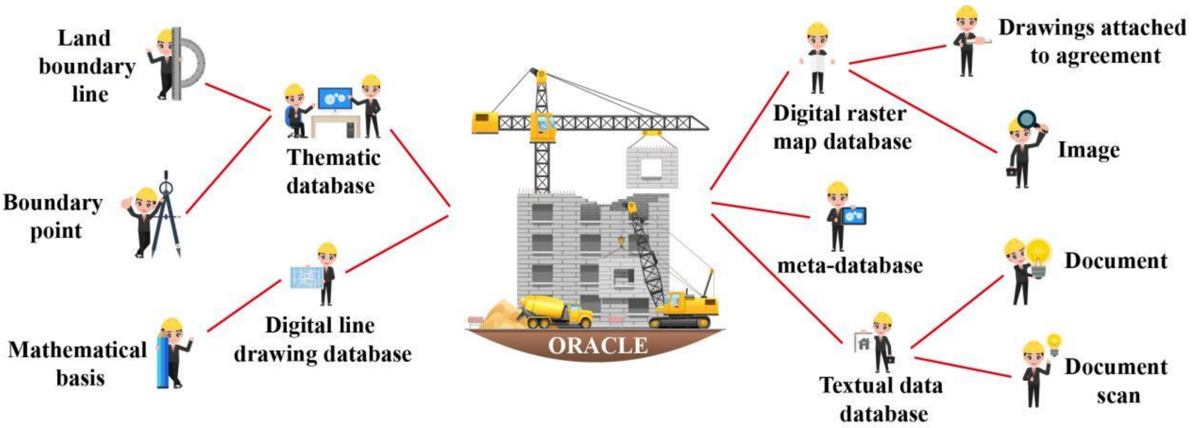

Figure 5: Database structure.

4 ANALYSIS OF RESULTS

4.1 Construction of Homestead Planning Information Management System

This system puts forward higher requirements for hardware. In order to ensure the normal operation of information management of rural homestead use rights, and to better utilize the application advantages of the system in the fields of digital office and digital city construction, the following requirements are made for hardware facilities:

- CPU: INTEL Celeron dual-core G1840 processor;
- Install the operating system: Windows7 Home Basic 32-bit;
- Hard drive: 500GB SATA hard drive (7200rpm);
- Port: USB2.0/3.0 port, DVI-D video port, RJ-45 network interface.

Based on the characteristics of the system and the management requirements for the spatial database, the software platform used in this project is as follows:

- Operating system: Windows 7 Home Basic 32-bit;
- GIS platform: MAPGIS K9 data center development platform;
- Database platform: Oracle 11gR2.

4.2 Analysis of Specific Examples

Using the homestead planning information management established above, the system analyzed the survey data and found that the total land area of a certain land was 143,334.82 hectares, including 119,330.59 hectares of agricultural land, 20,976.04 hectares of construction land, and 3,028.19 hectares of unused land. Among the construction land, collective construction land (village and mining land) has a total of 12,628.84 hectares, accounting for 60.21% of the construction land. The total amount of collective construction land in some townships and rural areas is 5969.76 hectares, accounting for 71.15% of the construction land. In the analysis, the rural collective construction land is subdivided into six categories, they are industrial storage and commercial land (3.72%), rural mining land (1.05%), public service and infrastructure land (0.83%), rural residential land (94.33%), mixed land (0.35%) and other construction Land use (0.07%), as shown in Figure 6. The program examined the survey data and discovered that a specific land's total land area was 143,334.82. Collective construction land (village and mining land) accounts for 60.21 percent of all construction land.

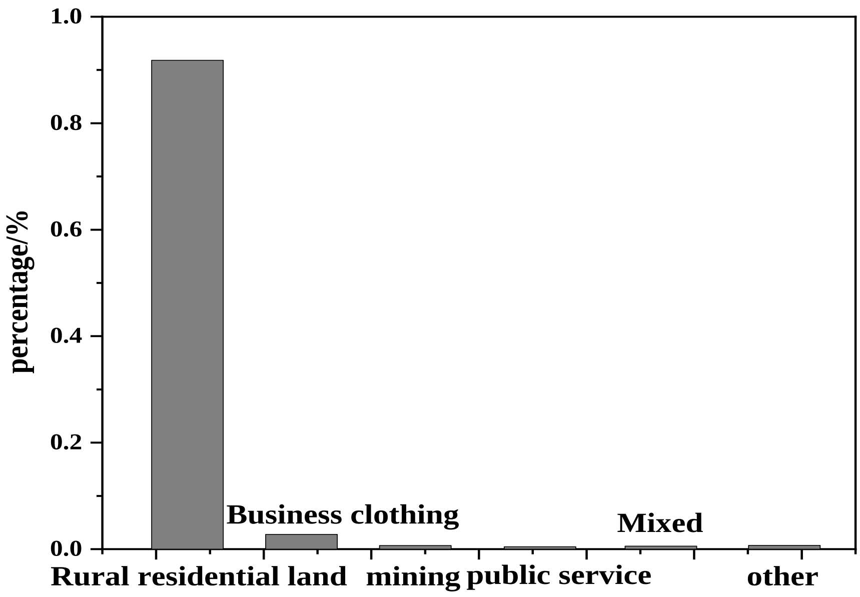

Figure 6: The proportion of rural collective construction land in a certain place.

The author researches and establishes an information management system based on an analysis of the present management demands of rural homestead use rights, using 3S space information technology and combining computer technology, database technology, and multimedia technology. The data is all stored in an Oracle database, and the spatial data is controlled using the MapGIS K9 spatial database engine. After the rural homestead planning information management system is completed and put into operation, it can not only resolve disputes arising from the determination of the ownership of rural homesteads, but also effectively utilize and protect the achievements of helping the community, it can also lay the foundation for government departments to realize office automation and unified management, and has broad application prospects in the census of land, forestry, agriculture and other national resources. Adopt the technology of spatial information management in geographic information system, it can significantly improve the work efficiency of assisting the determination of parcel boundaries and the management of land ownership, and provide technical support for the realization of digital office.

5 CONCLUSION

Establishing a rural homestead planning information management system may help to resolve the conflict between the application and storage of field measurement findings, as well as make land information management job more informative and scientific, resulting in increased productivity.
The geographical information of each data, including the physical position of the data and the topological interaction with other data, is directly related to the land boundary survey and the daily administration of tenure. The author created a rural homestead use right information management system by combining the creation and research of MapGISk9 platform software with the exploration of the demand for information management of rural homestead use right information. The following is a summary of the key work:

1) The author proposes a technical scheme for secondary development of the system based on the MapGIS K9 platform, the overall architecture and functional modules of the system are designed, and according to the characteristics of the thematic data of parcels and boundaries, in light of the work requirements and characteristics of rural homestead use rights management.
2) The proper information management system is based on the MapGISK9 component and the database operation component to suit the business function needs of the rural homestead. A number of functional modules have been created.
3) Through real operation, the author's homestead planning information management system has consistent performance, convenient operation, and a nice interface.
4) According to the analysis of the survey data, the total land area of a certain land is 143334.82 hectares, including 119,330.59 hectares of agricultural land, 20,976.04 hectares of construction land, and 3,028.19 hectares of unused land, using the homestead planning information management established above. Collective construction land (village and mining land) accounts for 60.21 percent of all construction land, with a total area of 12,628.84 hectares. In some townships and rural regions, the total quantity of communal construction land is 5,969.76 hectares, accounting for 71.15 percent of the overall construction land.

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REFERENCES

[1] Wang, L.; Jiang, D.; Energy management control system of prefabricated construction based on internet of things technology. International Journal of Internet Protocol Technology, 14(2), 2021, 86-91. https://doi.org/10.1504/IJIPT.2021.116256
[2] Liu, Z.; Kan, J.: Effect of basketball on improving the health of obese people under the monitoring of internet of things technology, Mobile Information Systems, 2021(7), 2021, 1-8. https://doi.org/10.1155/2021/9525062
[3] Garcia-Tenorio, C.; Mojica-Nava, E.; Sbarciog, M.; Wouwer, A.: Analysis of the ROA of an anaerobic digestion process via data-driven Koopman operator, Nonlinear Engineering, 10(1), 2021, 109-131. https://doi.org/10.1515/nleng-2021-0009
[4] Zhou, Y.; Sharma, A.; Masud, M.; Gaba, G. S.; Dhiman, G.; Ghafoor, K. Z.; AlZain, M. A.: Urban Rain Flood Ecosystem Design Planning and Feasibility Study for the Enrichment of Smart Cities, Sustainability, 13(9), 2021, 5205. https://doi.org/10.3390/su13095205
[5] Vedavathi, N.; Dharmaiah, G.; Venkatadri, K.; Gaffar, S.: Numerical study of radiative non-Darcy nanofluid flow over a stretching sheet with a convective Nield conditions and energy activation, Nonlinear Engineering, 10(1), 2021, 159-176. https://doi.org/10.1515/nleng-2021-0012

[6] Zhang, J.; Zeng, W.; Hou, S.; Chen, Y.; Li, Y.: A low-power and low-cost smart streetlight system based on internet of things technology, Telecommunication Systems, 79(1), 2021, 83-93. https://doi.org/10.1007/s11235-021-00847-1
[7] Raslan, K.; Ali, K.; Al-Jeaid, H.: N-dimensional quintic B-spline functions for solving n-dimensional partial differential equations, Nonlinear Engineering, 11(1), 2022, 123-134. https://doi.org/10.1515/nleng-2022-0016
[8] Li, G.; Liu, F.; Sharma, A.; Khalaf, O.I.; Alotaibi, Y.; Alsufyani, A.; Alghamdi, S.: Research on the Natural Language Recognition Method Based on Cluster Analysis Using Neural Network. Mathematical Problems in Engineering, 2021, 2021. https://doi.org/10.1155/2021/9982305
[9] González-Gaxiola, O.; Rach, R.; Ruiz de Chávez, J.: Solution for a rotational pendulum system by the Rach–Adomian–Meyers decomposition method, Nonlinear Engineering, 11(1), 2022, 156-167. https://doi.org/10.1515/nleng-2022-0021
[10] Chen, R.; Sharma, A.: Construction of complex environmental art design system based on 3D virtual simulation technology, International Journal of System Assurance Engineering and Management, 2021, 1-8. https://doi.org/10.1007/s13198-021-01104-z
[11] Zhang, X.; Rane, K. P.; Kakaravada, I.; Shabaz, M.: Research on vibration monitoring and fault diagnosis of rotating machinery based on internet of things technology, Nonlinear Engineering, 10(1), 2021, 245–254. https://doi.org/10.1515/nleng-2021-0019
[12] Qiao, X.; Integration model for multimedia education resource based on internet of things, International Journal of Continuing Engineering Education and Life-Long Learning, 31(1), 2021, 1-6. https://doi.org/10.1504/IJCEELL.2021.111849
[13] Sun, B.; Lv, Z.; Li, Q.: Obstetrics nursing and medical health system based on blockchain technology, Journal of Healthcare Engineering, 2021(2), 2021, 1-11. https://doi.org/10.1155/2021/6631457
[14] Neto, A. J. V.; Silva, F.; Neto, E.; Lemos, M.; Esposito, F.: A taxonomy of ddos attack mitigation approaches featured by sdn technologies in iot scenarios, Sensors, 20(11), 2020, 3078-3084. https://doi.org/10.3390/s20113078
[15] Xu, X.; Li, L.; Sharma, A.: Controlling messy errors in virtual reconstruction of random sports image capture points for complex systems, International Journal of System Assurance Engineering and Management, 2021, 1-8. https://doi.org/10.1007/s13198-021-01094-y
[16] Su, T.; Su, W.; Du, C.; Huang, Z.; Dong, J.; Hu, C.: Damage identification of wind turbine blades based on dynamic characteristics, Nonlinear Engineering, 11(1), 2022, 47-57. https://doi.org/10.1515/nleng-2022-0007
[17] Balyan, V.: Cooperative relay to relay communication using NOMA for energy efficient wireless communication, Telecommunication systems, 76 (2), 2021, 271-281. https://doi.org/10.1007/s11235-021-00756-3
[18] Balyan, V.: Channel Allocation with MIMO in Cognitive Radio Network, Wireless Personal Communication, 116, 2021, 45–60. https://doi.org/10.1007/s11277-020-07704-5
[19] Sharma, A.; Kumar, N.: Third eye: an intelligent and secure route planning scheme for critical services provisions in internet of vehicles environment, IEEE Systems Journal, 16(1), 2021, 1217-1227. https://doi.org/10.1109/JSYST.2021.3052072
[20] Bai, X.; Wang, Q.; Cao, S.: Application of infusion control system based on internet of things technology in joint orthopedics nursing work, Journal of Healthcare Engineering, 2021(4), 2021, 1-11. https://doi.org/10.1155/2021/6691258
[21] Sharma, A.: Recent trends in information and communication technologies (ICT) using emerging technologies, Recent Advances in Electrical & Electronic Engineering (Formerly Recent Patents on Electrical & Electronic Engineering), 14(1), 2021, 4-5. https://doi.org/10.2174/235209651401201209102007
[22] Hillier, C.; Balyan, V.: Error Detection and Correction On-Board Nanosatellites Using Hamming Codes, Journal of Electrical and Computer Engineering, 2019(6), 2019, 1-15. https://doi.org/10.1155/2019/3905094

[23] Balyan, V.: New OZCZ Using OVSF Codes for CDMA-VLC Systems, Advances in Intelligent Systems and Computing, 1235,2022, 363-374. https://doi.org/10.1007/978-981-16-4641-6_30
[24] Liu, H.; Yan, F.; Tian, H.: Towards low-carbon cities: patch-based multi-objective optimization of land use allocation using an improved non-dominated sorting genetic algorithm-ii, Ecological Indicators, 134(4), 2022, 108455-18460. https://doi.org/10.1016/j.ecolind.2021.108455
[25] Barman, A.; Sheoran, P.; Yadav, R. K.; Abhishek, R.; Kumar, S.: Soil spatial variability characterization: delineating index-based management zones in salt-affected agroecosystem of india, Journal of Environmental Management, 296(19), 2021, 113243-113248. https://doi.org/10.1016/j.jenvman.2021.113243
[26] Ahmed, N.; Lu, H.; Shakoor, A.: Irrigation supply and demand, land use/cover change and future projections of climate, in indus basin irrigation system, Pakistan, Sustainability, 13(16), 2021, 8695-8711. https://doi.org/10.3390/su13168695
[27] Jeong, K. W.; Yoon, H. I.; Lee, J. H.; Yeo, I.; Han, J. S.: Clinical feasibility of fully sintered (y, nb)-tzp for cad-cam single-unit restoration: a pilot study, Materials, 14(11), 2021, 27622-27626. https://doi.org/10.3390/ma14112762
[28] Song, D. B.; Han, M. S.; Kim, S. C.; An, J. Y.; Lee, H. H.: Influence of sequential cad/cam milling on the fitting accuracy of titanium three-unit fixed dental prostheses, Materials, 14(6), 2021, 1401-1406. https://doi.org/10.3390/ma14061401
[29] Espinoza, R. V.; Haatveit, K. C.; Grossman, S. W.; Jin, Y. T.; Sherman, D. H.: Engineering p450 tami as an iterative biocatalyst for selective late-stage c-h functionalization and epoxidation of tirandamycin antibiotics, ACS Catalysis, 11(13), 2021, 8304-8316. https://doi.org/10.1021/acscatal.1c01460
[30] Gao, S.; Bhagi, L. K.: Design and research on caddcam system of plane based on nc machining technology, Computer-Aided Design and Applications, 19(S2), 2022, 64-73. https://doi.org/10.14733/cadaps.2022.S2.64-73
[31] Leuken, D.; Meijere, C.; Horst, R.; Banine, V. Y.; Osorio, E. A.; Beckers, J.: An atomic hydrogen etching sensor for h2 plasma diagnostics, Review of Scientific Instruments, 92(6), 2021, 063518-063522. https://doi.org/10.1063/5.0033518
[32] Ignaczak, L.; Goldschmidt, G.; Costa, C.; Righi, R.: Text mining in cybersecurity: a systematic literature review, ACM Computing Surveys, 54(7), 2021, 1-36. https://doi.org/10.1145/3462477
[33] Kang, S. H.; Lee, H. D.; Lee, S. D.; Rho, D. S.: A study on fault analysis of ±35kv mvdc hybrid distribution system using pscad/emtdc, Transactions of the Korean Institute of Electrical Engineers, 70(8), 2021, 1117-1128. https://doi.org/10.5370/KIEE.2021.70.8.1117
[34] Lan, G.; Zhang, Z.; Shah, M.: Key technology of caddcam integration for complex parts of marine diesel engine, Computer-Aided Design and Applications, 19(S2), 2021, 99-111. https://doi.org/10.14733/cadaps.2022.S2.99-111
[35] Zhou, H.; Zhao, G.: Research on reverse engineering reconstruction of parts cad model for additive manufacturing, MATEC Web of Conferences, 336(4), 2021, 02007-02013. https://doi.org/10.1051/matecconf/202133602007
[36] Cadar, O.; Dinca, Z.; Senila, M.; Torok, A. I.; Levei, E. A.: Immobilization of potentially toxic elements in contaminated soils using thermally treated natural zeolite, Materials, 14(14), 2021, 3777-3784. https://doi.org/10.3390/ma14143777
[37] Aydin, F.; Durumeric, A.; Hora, G.; Nguyen, J.; Swanson, J.: Improving the accuracy and convergence of drug permeation simulations via machine-learned collective variables, The Journal of Chemical Physics, 155(4), 2021, 045101-045106. https://doi.org/10.1063/5.0055489