Research On Key Technologies Of Equipment Support Intelligent System

Jian Chen, Yan Wang and Xuepeng Jiang
Naval Aviation University, Yantai Shandong 264001, China.
E-mail: 57991949@qq.com

Abstract. In view of the rapid development of information technology, the construction requirements of intelligent equipment support system are proposed based on the results of intelligent construction. On the basis of putting forward the logical framework of the intelligent equipment support system, this paper analyzes its technical framework. To provide theoretical support for the construction of the intelligent support system, analyze its key technologies, especially the concepts of GIS visualization technology, Internet of things technology, deep learning technology and big data technology, and their functions in the intelligent equipment support system.

1. Introduction
In recent years, with the rapid development of the Internet of things, cloud computing, mobile Internet, big data and other new generation of information technology, smart city, smart campus, smart hospital and other smart information systems have been widely studied and practiced on this basis. The basic idea of intelligent information system is to realize the agile perception, effective decision-making and regulation of complex system through comprehensive perception of information collection, safe transmission of information, intelligent and efficient processing of information, so as to improve the operation efficiency of the system. It can be seen that the IOT of information sources, the digitalization and networking of information are the basis of intelligent information system, which is the advanced form of information development. At present, with the early accumulation of military information construction, the military equipment support site has already had the foundation of information digitization and networking, but the transformation of information efficiency is very limited, which can not meet the needs of the transformation of the combat effectiveness of the army. Building the intelligent system of equipment support is the inevitable trend of the development of the information construction of the ordnance support force to the advanced stage and breaking the information efficiency bottleneck.

2. Equipment Support Intelligent System
Equipment support system is the business support of all levels of ordnance support forces to carry out various support activities. It is an important data node in the informatization construction of ordnance support. It carries the important functions of collection, storage, transmission, integration, utilization and support of basic data and business data. It is an indispensable basic link in the information network of ordnance support [1-5].

The digital system of equipment support refers to the realization of the digitalization of various elements of equipment support based on the network, using advanced information technology and maintenance support theory. On the basis of the traditional equipment support business system, a network support platform integrating personnel, equipment and workflow is built to improve the...
efficiency of the traditional position, expand the function of the traditional equipment support system, and finally realize the comprehensive informatization of equipment support, so as to realize the leapfrog development of equipment support mode, method and means [6-9].

Equipment support intelligent system is based on the digital system, according to the requirements of equipment support business, by equipping sensors in various support facilities, equipment and position environment, forming the Internet of things, realizing real-time collection and transmission of entity information, and relying on advanced information processing and analysis technology such as cloud computing, forming the intelligent decision-making and intelligent management[10-12].

3. The Logical Architecture of Intelligent Equipment Support System
In order to support the realization of intelligent equipment support function, the framework level of the overall logic architecture of the system is mainly divided into four levels. It includes infrastructure layer, data layer, support platform layer and application layer. Through the application of those levels, the perfect integration of the system in openness, practicality, security, maintainability, scalability, standardization and performance is realized. It provides a more reliable 3D data application experience for users, as shown in the system hierarchy structure figure 1.

Figure 1. Overall logical architecture
3.1 Infrastructure Layer
The Infrastructure layer includes LAN, storage equipment, server facilities, computer facilities, network security facilities, input and output equipment, operating system, database, etc.. It provides basic hardware and software support for the development and operation of the platform.

3.2 Data Layer
The data layer mainly includes GIS geographic database, spatial information database, three-dimensional model database, plan deduction knowledge database and system business database, providing basic data services for the platform. The data layer is realized by relational database and spatial database, including metadata, basic terrain spatial data, underground pipeline data, image and multimedia data, plan knowledge, interface data, etc.. It is responsible for the update, configuration, release and physical storage of 2D data, 3D data and attribute data, including safety detection data, various equipment attribute data, 3D geographic information Model data, etc.

3.3 Platform Support Layer
Platform support layer is the core of the system, including platform core engine, support service and system integration interface, which provides support for system integration, situation display and integrated application. The core engine includes 2D GIS Engine, 3D core engine and ESB service bus, among which 2D GIS Engine provides support for 2D situation integration, 3D core engine provides support for 3D scene rendering, and ESB service bus provides basic services for system and data integration.

3.4 Application Layer
The application is mainly for users and provides users with human-computer interaction functions. Specifically, it includes three aspects: the whole process fine control of equipment support; the wholly-owned monitoring and control of safety elements and the auxiliary decision support of emergency disposal.

4. Intelligent System Technology Architecture
The technical architecture of the system is shown in Figure 2, which basically lists the relevant software, tools and key technologies in the development process of the platform. The platform software development is based on Java EE integrated environment and adopts SOA architecture to optimize the system functions and minimize the technical interdependence within the overall platform[13-14].

![Figure 2. Technical framework of the platform](image-url)
5. Key Technologies of Intelligent System

5.1. GIS Visualization Technology
Visualization technology is an effective way to help people understand and manage information. Geographic Information System (GIS) is one of the most widely used visualization techniques. GIS can provide users with 3D building model and street view of desktop or mobile position, as well as real-time access to all kinds of scene information[15].

NewMap is a network oriented service GIS software. In the phase of digital city construction, the software takes the lead in breaking the desktop application mode of traditional GIS software with software as the core, realizing the construction of geographic information public service platform, and the construction standards and norms of the platform eventually become the overall standards and norms of national digital city construction. In the construction stage of smart city, according to the characteristics of smart city construction, the construction standard of spatiotemporal information cloud platform is proposed to guide the construction of smart city in the post digital city construction stage. The overall technical framework and application logic of NewMap are shown in Figure 3.

![Figure 3. GIS application framework based on NewMap](image-url)
5.2. Internet of Things Technology

As the cutting-edge technology of the information industry revolution, the Internet of things has a strong ability of network integration, which can realize the interaction between things and people. It integrates the relevant elements of military engineering, realizes the seamless connection of information and the integrated management of relevant elements.

In the construction of intelligent position, the objects that need to be sensed are identified by using 2D code, RFID, embedded, wireless sensor, satellite positioning and other technical means. Then the information identification equipment is used to identify the identification information, and the digital information of the sensed objects is obtained. Then the information is timely and accurately transmitted to the information processing center through network technology. After comprehensive analysis and intelligent processing, it can provide real-time support resource situation and support for command and decision-making.

The typical structure diagram of the Internet of things is shown in Figure 4, which can be roughly divided into five parts: electronic tag, reader, Internet of things middle ware (IOT-MW), Internet of things name service (IOT-NS) and Internet of things information service (IOT-IS).

![Figure 4. Structure of Internet of things](image)

5.3. Deep Learning Technology

Deep learning refers to the technology that machines learn, judge and make decisions by imitating the deep neural network established by human brain and the mechanism of human brain. It has been widely used in face recognition, speech recognition, note recognition and other fields.

In the intelligent position, the face recognition algorithm trained by deep neural network can greatly improve the recognition accuracy. In short, it is to let the neural network that has pre-set the prior knowledge of face recognition in the network structure, read a large number of different face pictures that many people are photographed in various environments (such as light, perspective, expression), automatically learn and extract the low, medium and high-level features of various parts and scales of the face, after a large number of learning, the machine can according to the provided template information distinguishes different people. In the intelligent position, deep learning technology can be used to identify the roles of different personnel and the physical status of personnel in the work of security protection.

5.4. Big Data Technology

Big data refers to the data collection which can not be analyzed, processed and managed by traditional database software in a certain period of time. Generally, four V can be used to summarize the basic characteristics of big data: volume, variety, value and velocity.

The big data technology used in the smart position should focus on the storage of massive structured and semi-structured data in the system, provide rapid data retrieval, analysis and statistical application, and make research, judgment and prediction on the development trend of the security situation through the in-depth association analysis of big data, based on the four characteristics of big data and combined with the actual needs of the management and control business.
6. Conclusion
From the four levels of infrastructure, data, support platform and application, this paper analyzes the overall logical architecture of the equipment support intelligent system. From the platform support, data processing and security technology, this paper analyzes the overall technical framework of the equipment support intelligent system. Finally, the paper analyzes the key technologies involved in the construction of intelligent system of equipment support, which provides strong technical support for the subsequent construction of intelligent position of ordnance technology.

7. References
[1] United States Government; Patent Issued for Equipment Shipping, Storage, And Maintenance Support System (USPTO 10,604,339)[J]. Journal of Engineering, 2020.
[2] Julio M O, NORBERTO C G, MARIA D G. A decision support system for a capacity management problem at a container terminal[J]. International Journal of Production Economics, 2020, 222.
[3] SHAO Q, JIA M, Xu C C, FENG X J. A support system for civil aviation navigation equipment security management[J]. Safety Science, 2020, 123.
[4] Daikin Industries Ltd.; Researchers Submit Patent Application, "Equipment Installation Support System", for Approval (USPTO 20190394278)[J]. Telecommunications Business, 2020.
[5] YUMA T, MASAYA W. Development of a control system for support equipment in operation support system,[J]. Journal of the Japan Society of Applied Electromagnetics and Mechanics, 2019, 27(1).
[6] WANG L B, CUI X T, ZHANG F G, et al. Research of Equipment Support Informatization Construction under the New Period[J]. National Defense Science& Technology, 2013, 34(4): 79-82. (in Chinese)
[7] WEI Z L, CHEN C L, SHEN Y, et al. Research on Capability Requirement Satisfactory Degree Evaluation Model of Support Equipment for Digital Forces [J]. Fire Control & Command Control, 2017, 42(3):90-95. (in Chinese)
[8] WANG H Q, GU P, WANG Z G. Analysis on RMS Parameter of Typical Digital Equipment [J]. Computer& Digital Engineering, 2017, 45 (1): 5–7, 100. (in Chinese)
[9] HE G L, PU W, FAN Y P, et al. Multi-level Evaluation for Digitized Troops Equipment Support Scheme Based on Effectiveness Simulation[J]. Journal of Academy of Armored Force Engineering, 2016, 30(1): 14-20. (in Chinese)
[10] He Fu, Du Yikun, Xu Tao, et al. Intelligence Improvement in Wind Tunnel Facility Management Based on Informatization Thinking[J]. Ordnance Industry Automation, 2017, 36(10): 17-20, 28. (in Chinese)
[11] REN X, LIU M Z, CHEN X H, et al. Analysis of Construction of “Wisdom Logistics Equipment Support System” [J]. Journal of Sichuan Ordnance, 2015,36(8):78-81.
[12] QIAN Y L, LIU F J, YIN X H. Constructing a “Cloud of Logistics Support” to Realize “Knowledge Centered” Logistics Support[J]. National Defense Science& Technology, 2015, 36 (1):26–30.
[13] LI B, DONG K F, FENG C F. Research on Intelligent Architecture of New Generation Public Security Traffic Management[J]. Intelligent Transportation, 2019, 3 (56):72–76.
[14] DU Y Q. Research on Smart Spatial System from Perspective of Epistemological Paradigm[J], Science of Surveying and Mapping, 2014, 39 (8): 7–10.
[15] LIU B B, CHEN F X, LIU J X. Rapid Visualization Technology of Forest Area Vector Data Based on Mobile GIS[J]. Journal of Northwest University (Natural Science Edition), 2020, 50(2): 295–303.