BIBLIOGRAPHIC INFORMATION SYSTEM

Journal Full Title: Journal of Biomedical Research & Environmental Sciences

Journal NLM Abbreviation: J Biomed Res Environ Sci

Journal Website Link: https://www.jelsciences.com

Journal ISSN: 2766-2276

Category: Multidisciplinary

Subject Areas: Medicine Group, Biology Group, General, Environmental Sciences

Topics Summation: 128

Issue Regularity: Monthly

Review Process type: Double Blind

Time to Publication: 7-14 Days

Indexing catalog: Visit here

Publication fee catalog: Visit here

DOI: 10.37871 (CrossRef)

Plagiarism detection software: iThenticate

Managing entity: USA

Language: English

Research work collecting capability: Worldwide

Organized by: SciRes Literature LLC

Manuscript should be submitted in Word Document (.doc or .docx) through **Online Submission** form or can be mailed to support@jelsciences.com

Vision

Journal of Biomedical Research & Environmental Sciences main aim is to enhance the importance of science and technology to the scientific community and also to provide an equal opportunity to seek and share ideas to all our researchers and scientists without any barriers to develop their career and helping in their development of discovering the world.

JOURNAL OF BIOMEDICAL RESEARCH & ENVIRONMENTAL SCIENCES
ISSN: 2766-2276
SUBJECT AREA(S): ENVIRONMENTAL CONTAMINATION | BIOLOGICAL OCEANOGRAPHY
DOI: 10.37871

RESEARCH ARTICLE

Application of Water Conservancy Informatization in River and Lake Management

Cheng Guosen[1], Zhu Jin[2], Gui Shubiao[2] and Li Kaikai[2]*

[1]Qujing Branch of Yunnan Hydrology and Water Resources Bureau, Qujing 655000, China
[2]School of China Three Gorges University, YiChang, 443002, China

ABSTRACT

In order to solve the problems of heavy workload, low efficiency, inconvenient transportation and complex terrain, difficulties in regional monitoring and evidence collection, and insufficient quantitative analysis ability in traditional river and lake management, this paper studies and summarizes the literature and policies related to river and lake information management by using the integration of Internet, UAV, GIS and other technologies in recent years, The technical methods and means of river and lake management and protection are put forward to provide reference for improving water management system and ensuring water safety.

BACKGROUND

Rivers and lakes have important resource functions and ecological functions. They are channels of flood, carriers of water resources and important components of ecological environment. With the development of economy and society, the space of rivers and lakes has been squeezed and occupied by human activities. However, in the traditional dynamic monitoring of rivers and lakes, the workload is heavy, the efficiency is low, the traffic is inconvenient, the terrain is complex, the regional monitoring and evidence collection is difficult, and the quantitative analysis ability is insufficient.

In 2015, the CPC Central Committee and the State Council issued "opinions on accelerating the construction of ecological civilization" (ZF [2015] No. 12), which proposed to "strengthen statistical monitoring, and emphasize the use of satellite remote sensing and other technical means to carry out all-weather monitoring of natural resources and ecological environment protection, and improve the monitoring network system covering all resources and environmental elements". In 2016 and 2017, the general office of the CPC Central Committee and the general office of the State Council respectively issued" the opinions on the comprehensive implementation of the river head system" and "the guidance on the implementation of the lake head system in lakes", and clearly put forward that "we should actively use satellite remote sensing, UAV, video monitoring and other technologies to strengthen the dynamic monitoring of lake changes". "The key points of river and Lake Management in 2020" issued by the Ministry of water resources on February 25, 2020 calls for strengthening the comprehensive improvement of river sand mining, further strengthening the system of river and lake head and the secret inspection of river and lake management, and strengthening the basic work of river and lake management. Internet plus Unmanned Aerial Vehicle (UAV) technology

***Corresponding author**

Zhu Jin, School of China Three Gorges University, YiChang, 443002, China

Tel: +86-155-879-46449
E-mail: 1344963001@qq.com

DOI: 10.37871/jbres1275

Submitted: 20 June 2021

Accepted: 07 July 2021

Published: 08 July 2021

Keywords

- Dynamic monitoring of rivers and lakes
- Information management
- GIS technology
- Wisdom river lake long system

ENVIRONMENTAL SCIENCES
ENVIRONMENTAL CONTAMINATION
BIOLOGICAL OCEANOGRAPHY

VOLUME: 2 ISSUE: 7

How to cite this article: Guosen C, Jin Z, Shubiao G, Kaikai L. Application of Water Conservancy Informatization in River and Lake Management. J Biomed Res Environ Sci. 2021 July 08; 2(7): 548-554. doi: 10.37871/jbres1275, Article ID: JBRES1275, Available at: https://www.jelsciences.com/articles/jbres1275.pdf

is a effective way to strengthen the management of rivers and lakes. Research, analysis, design and development of river and lake management dynamic monitoring system is an urgent need to explore the establishment of river and lake resources monitoring network system, and effectively improve the efficiency of river and lake water shoreline management and protection.

The purpose and significance of the research

The dynamic monitoring of rivers and lakes based on Internet and UAV is conducive to further improve the monitoring network system of river and lake resources, strengthen the management and protection of river and lake water shoreline, and provide powerful tools and means for further strengthening the protection of rivers and lakes, real-time, dynamic and accurate capture of river and Lake information. It can provide accurate information for river and lake ecological environment governance, accurate decision-making for river and lake governance, real and comprehensive effective information, and provide tracking service and effect evaluation for follow-up work, which has good ecological and environmental benefits.

River and lake management involves water area, shoreline, water and sand fishery resources, sewage outfall setting, river related construction projects and other aspects. It is the core content of river and lake supervision and management and water conservancy social services. It is an important work to ensure the sustainable utilization of river and lake resources, and it is a hard task of current water conservancy work. Under the current situation, the application of Internet plus UAV technology to dynamic monitoring of river and lake management is an effective way to strengthen River and lake management. The design and development of dynamic monitoring system of river and lake management is an urgent need to establish the monitoring network system of river and lake resources and strengthen the management and protection of river and lake shoreline. Under the background of big data, the application of modern technology to river and lake management meets the requirements of modern development and shows the characteristics of intelligent water conservancy.

Survey of domestic and international levels and trends

Research status abroad: In recent years, foreign UAV, GIS, AR and other technologies are gradually widely used in the field of water conservancy, and some experts seek to integrate these technologies into the software system to realize the informatization of water conservancy management. In 2008, Japan's Sozaki Temharu and others won the invention patent of river information management system. Using mobile phone integrated camera and GPS equipment, the mobile phone can take images reflecting the abnormal situation of rivers and upload them to the server. Kubota S, et al. described how to use UAV aerial images to form 3D maps to achieve long-term management of water conservancy facilities, and discussed the fine verification method of images in detail. Roberto Pierdicca and others introduced a set of intelligent terminal equipment for realizing intelligent watershed management by combining GIS and AR technology, and pointed out that the equipment can effectively improve the efficiency of large-scale water conservancy monitoring carried out by government departments and communities after field monitoring.

Domestic research status: Strengthening the management of rivers and lakes and realizing the smooth flow of rivers, clear water, green shore and beautiful scenery are the urgent needs of building a beautiful China and establishing an ecological civilization system, the inevitable requirements of promoting industrialization, urbanization, agricultural modernization and ensuring the sustainable development of economy and society, and the important contents of deepening water conservancy reform. River and lake management is an important part of water management system, and it is also an inevitable requirement to maintain the life and health of rivers and lakes and ensure the national water safety. In recent years, all localities have taken active measures to strengthen the management of rivers and lakes, which has promoted the comprehensive benefits of flood control, water supply, power generation, shipping, ecology, and strongly supported the sustainable development of economy and society.

From 2016 to 2017, the leading group of the Central Committee for comprehensively deepening reform, the general office of the CPC Central Committee and the general office of the State Council successively issued "the opinions on comprehensively implementing the river head system" and "the guiding opinions on implementing the lake head system in lakes". Subsequently, the local governments successively issued the work plans and objectives on implementing the river head system and the lake head system, and established the river head system and the lake head system The system of river and Lake Management Based on Lake leader system In "the opinions on comprehensively implementing the river head system", it clearly puts forward the work requirements of strengthening the management and protection of river and lake water shoreline, strengthening law enforcement and supervision, and establishing the daily supervision and inspection system of river and lake. The supervision of shoreline resources has the characteristics of many points, wide range and heavy workload, which is a complex system engineering. The traditional river and lake shoreline supervision is mostly carried out in the form of manual inspection, hierarchical reporting and public complaints. There are problems such as untimely information collection, single source and form, and incomplete coverage, which make it difficult to realize real-time and normalized comprehensive inspection and overall supervision. In addition, there are many problems in traditional management units, such as lack of professional

and technical personnel, informatization and low degree of modernization of supervision means, resulting in low efficiency of river and lake shoreline supervision. The monitoring and management system of river and lake shoreline is designed and developed based on rich client, 3D geographic information system and spatial database technology, which can provide strong technical support for the upgrading of river and lake shoreline supervision technology, the improvement of daily supervision and inspection system, and the protection of river and lake shoreline resources.

"The key points of management of rivers and lakes in 2020" issued by the Ministry of water resources in February 25, 2020 pointed out that the management of rivers and lakes should be guided by Xi Jinping's new socialist ideology with China characteristics, and thoroughly study and implement the spirit of general secretary Xi Jinping's important speech on the protection of the Yangtze River and the ecological protection and quality development of the Yellow River Basin, and comprehensively implement the priority of water conservation, space balance, and system governance. We should adhere to the principle of "making up for the shortcomings of water conservancy projects and strengthening the supervision of water conservancy industry", adhere to the principle of problem orientation, goal orientation and result orientation, and adhere to the principle of being pragmatic, efficient and effective. We should take promoting the system of "famous" and "practical" as the main line, and strengthen the duty performance of the head of rivers and lakes, We should do a good job in the normalization and standardization of the "four chaos" of rivers and lakes, the comprehensive improvement of sand mining in rivers and lakes, strengthen the system of river and lake leaders and the secret inspection of river and lake management, consolidate the basic work of river and lake demarcation, planning, system construction, informatization, etc., and spare no effort to fight the tough battle of river and lake management by establishing rules, consolidating foundation, building mechanism, strengthening supervision, and seeking innovation, We will continue to promote the modernization of the river and lake management system and capacity, promote the fundamental improvement of rivers and lakes, build beautiful and healthy rivers and lakes, and make every river a happy river for the benefit of the people [1-14].

In view of the river and lake management, Wang Hongxia [15] and others put forward the idea of comprehensively improving the informatization level of river and lake management.

- Comprehensively promote the information construction of water resources management. Based on the construction of industry database, network platform and automatic monitoring system, the water resources management information system based on GIS is established by using advanced computer network, informatization and digitization technology to realize the collection, storage, analysis, update, query, management, output and visualization of water resources information and improve the service platform, The water resources real-time monitoring information subsystem, water resources information management subsystem based on GIS, water intake permission management information subsystem, water resources reasonable allocation information subsystem and water resources forecast information subsystem will be constructed;

- The automatic monitoring information system of river and lake water quality was established. The main function of the water quality automatic monitoring system is to collect the water quality, flow and discharge information of each water quality monitoring section and sewage outlet water quality monitoring section, transmit them to the water resources and environment management center, process them and store them in the professional database for query, management and decision support. These information must reflect the requirements of real-time, reliability and integrity. The monitoring items of water quality monitoring section are conventional parameters, ammonia nitrogen, total nitrogen, total phosphorus, etc. The monitoring items of sewage outlet water quality monitoring section are pH value, COD, Cr and flow. The water quality automation construction system mainly includes telemetry station, central station and information transmission network.

- More efforts should be made to compile electronic water system map. Most of the water system maps used in the past are paper maps, which are not conducive to preservation, and the information update is slow. China's water system is developed, there are many rivers and lakes, and the water system information is large and updated quickly. The paper water system map has been unable to meet the needs of modern water conservancy development. The electronic water system map is to collect and sort out the basic data of all rivers within the scope of each administrative region, compile them into a database, and finally form multiple application systems of query, management, decision-making, prediction, statistical report and modification of the whole water system and surrounding buildings;

- Establish a perfect water conservancy information construction organization system. Water administrative departments at all levels should strengthen the leadership of water conservancy informatization work, clarify the leading institutions, improve the working mechanism, clarify the

rights and responsibilities of informatization work institutions, informatization application departments and management and maintenance departments in informatization construction and management, and establish a good work pattern of performing their duties and cooperating closely.

Hu Jinxian [16] in Shanghai Qingpu District, using Internet plus technology, has long term management of rivers and lakes in the area. In the long-term management system and mechanism of the river, the integrated management and maintenance of inspection, cleaning and maintenance should be realized. In terms of operation force, market-oriented maintenance companies should be guided to increase the investment of automatic operation vessels and front-line maintenance personnel. On the basis of improving the system and mechanism and consolidating the operation force, by making full use of high-resolution remote sensing, industrial UAV, Beidou navigation, information system, big data analysis and other new technologies, we will carry out pilot River inspection automation and ship monitoring informatization, establish an air space integrated inspection and monitoring system, and completely change the past relying on "human monitoring" and "ship monitoring" The traditional management mode of "telephone monitoring" lays the foundation for the realization of fine management, informatization of supervision and quantitative assessment. Taking the Pearl River Delta river network area as an example, Liu Jingao [17] designed the intelligent supervision scheme for the water shoreline, and the management and protection of the water shoreline is one of the main tasks of implementing the river lake leader system. The solution to the intelligent supervision of river and lake shoreline is to focus on "reinforcing the weakness of water conservancy projects and strengthening the supervision of water conservancy industry". The Ministry of water resources and the local government have also successively introduced the medium and long-term work plan of river and lake long-term system integrating the concept of intelligent River and lake management. It is mainly reflected in: using Internet thinking to promote the deep integration of cloud computing, big data, Internet of things, artificial intelligence and other new technologies with river and lake management, and build an intelligent management platform with comprehensive perception of river and lake dynamics, full sharing of river and lake information, and intelligent and thoughtful River and lake service. In order to reduce the workload of river patrol and make up for the environmental pollution and river bank encroachment after the end of river patrol, the current river lake leader system expands the supervision of river and lake shoreline from three aspects: the diversification of supervision means, the accuracy of supervision content and the quantification of supervision problems, so as to build an upgraded intelligent supervision system of river and lake shoreline. Integrating the mode of smart River and lake supervision, introducing multi-dimensional monitoring means and intelligent perception and big data mining technology, the supervision technical schemes for different supervision problems and river sections with different characteristics are formulated respectively. Wang Zaiai [18] and others developed the four rivers and Dongting Lake River and lake management information platform, applied mobile Internet, image and video compression, GIS and other technologies, put the relevant data of river and lake management into the database, and displayed them through the web and mobile terminals, carried out on-site verification and supervision of the violations around the river and lake, effectively blocked the loopholes of river and lake supervision, and realized the traceability of business data. After the completion of the river and lake management information platform, users can browse the news information, work dynamic and government information related to river and lake management through personal computers and mobile phones, and transfer the river and lake management documents and policy information. Combined with satellite remote sensing image and digital map, online view the attribute information of rivers and lakes and main water conservancy projects, analyze the evolution of river regime and the utilization of river and lake shoreline. Online supervision (photographing and positioning) of violations of laws and regulations related to rivers and lakes, through the river and Lake Management app, the public and management personnel can report violations of laws and regulations in the process of river and lake management. Verification of water related projects in the main stream and Dongting Lake area. Establish the river and lake management database.

In short, various studies show that it is feasible and effective to apply Internet technology and remote sensing technology to river and Lake Management in combination with the background of the times and the environment of big data. However, at present, most of the researches on using modern technology to realize digital monitoring of rivers and lakes are aimed at one or several of them. Very few of them will monitor the water quality changes of different monitoring objects, such as water area, shoreline, sand mining, sewage outlet setting, river related construction projects, etc., and carry out hydrological situation calculation and shoreline dynamic analysis in combination with hydrological climate, And dynamic change detection and early warning are integrated on one platform to form a powerful and complete platform system [19,20].

The research method proposed in this paper

1.3.1. **General technical route:** This paper combines the Internet and UAV remote sensing technology to build a dynamic monitoring system of river and lake management, to carry out daily inspection and dynamic monitoring of rivers and lakes, and to develop mobile app to realize the national participation in supervision (Figure 1). In the demonstration area, a tributary of the North Bank of the middle reaches of the Yangtze River, Juzhang River Basin, where JuShui and zhangshui meet at the two estuaries of

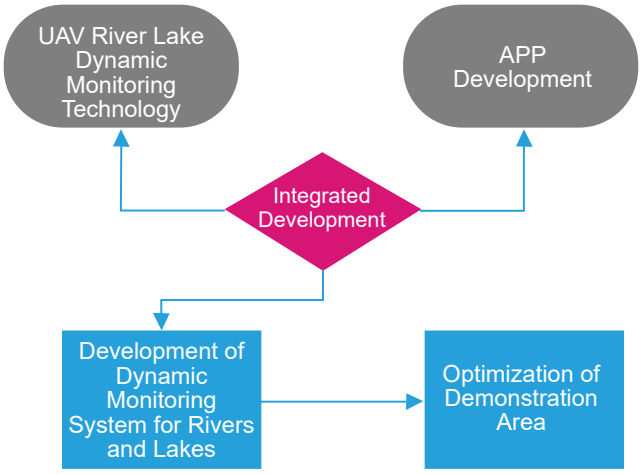

Figure 1 Technology roadmap.

Dangyang, will be selected to test the system and optimize the overall technical route in the demonstration area.

While conceiving the technical route, the research scheme is analyzed in detail, including UAV River and lake dynamic monitoring technology, large range UAV, selection of airborne high-definition camera, application of UAV equipped with high-definition camera, photographing River and lake micro topography, monitoring river and lake water quality change, processing and extracting image data, and defining and optimizing UAV voyage, navigation and navigation according to different monitoring tasks Flight altitude, route setting, flight angle, photo frequency, photo synthesis and other related parameters, research on UAV's interpretation characteristics of different monitoring objects, achieve the effect of automatic recognition according to the spectral characteristics, processing technology of UAV remote sensing information, including geometric correction, area network adjustment, orthorectification, color matching and other basic preprocessing, As well as the need for information retrieval technology (such as extraction of water, shoreline) and other issues on the demonstration study.

Research and development of river and lake dynamic monitoring system

Building the overall structure of the system: The overall architecture of the system includes information storage layer, data processing layer, data access layer and application service layer. The information storage layer is located at the bottom of the system, mainly in the database formats of basic geographic data, census and inspection data, hydrometeorological data and planning results data; The data processing layer mainly realizes the processing function of external remote sensing data, and integrates the processing technology of UAV remote sensing information; The data access layer mainly realizes the data import library and related processing functions, including data input and output, vector raster display mapping, vector slice, image slice, 3D terrain image slice, etc; The application service layer is located at the front end of the system to realize the main business and functions of river and lake management, including user management, system operation and maintenance management, river and lake basic information management, river and lake planning management, river and lake management and protection information management, river and Lake construction project management, river and lake illegal activities management, river and lake daily inspection management (Figure 2).

Basic functions of development system: On the platform of spatial geographic information, UAV monitoring data is linked with spatial position to realize basic functions such as basic information display, real-time communication, hydrological situation calculation and water shoreline dynamic identification. Information display directly shows the water system, river morphology and water related project distribution, supports the query and statistics of river and lake or water related project geographic location, administrative division, management subject and operation status, and supports the production and printing of thematic map; Real time communication supports the networking operation of mobile communication terminal, including the management of data and information through the mobile terminal, and the release of management information to the mobile terminal; The hydrological situation calculation is supported by the spatial geographic information platform, which enables the system to support hydrological model integration, flood risk map making, inundation range calculation and disaster situation analysis Survey and other work; The dynamic identification of water shoreline is based on the management information database of rivers and lakes, superimposed with timely updated remote sensing image map, and applied image analysis and identification to timely detect unauthorized wading behaviors, such as illegal wading engineering construction, illegal sand mining, etc., and provide early warning and forecasting information.

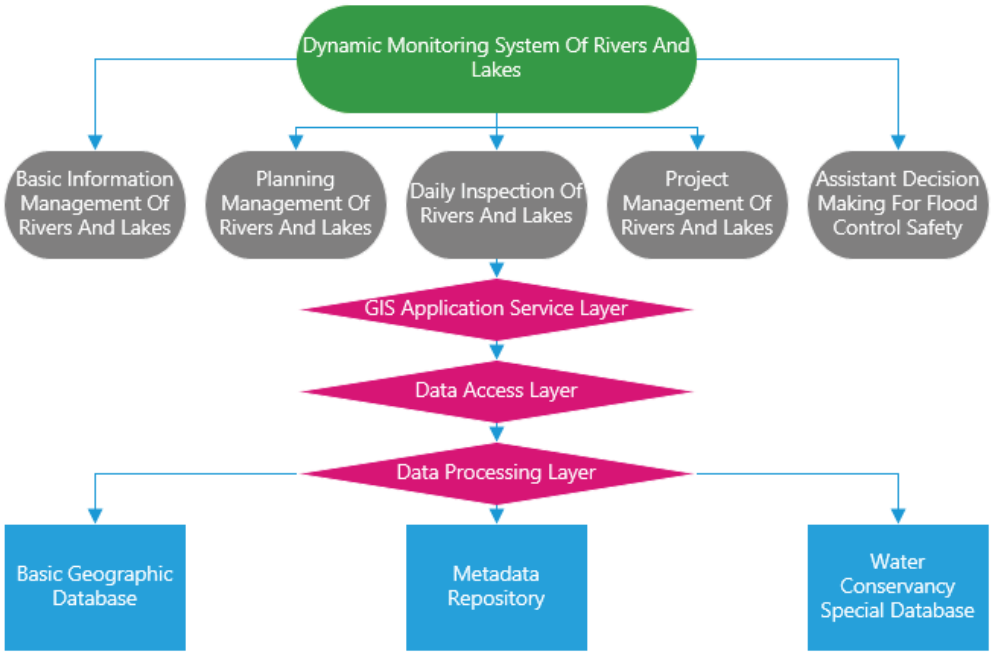

Figure 2 Framework of the system.

Design the business function subsystem of the system: In order to meet the demand of dynamic monitoring of river and lake shoreline and realize the main task of river and lake management, the dynamic monitoring system of riv+er and lake management, based on the basic functions, designs and develops the business function subsystems of basic information of river and lake management, river and lake planning and management, daily inspection of river and lake, dynamic analysis of water shoreline, auxiliary decision-making of flood control safety, disaster verification, etc. Finally, we will develop an app that can take photos and upload reports with the function of information release; Specification setting and UI design, i.e. visual presentation of APP; the framework design of the product includes front-end and back-end. The front-end needs the corresponding design language, which is designed according to the product specifications. The back-end is responsible for the whole business logic and provides the storage and query interface for the front-end. Finally, the product is tested to modify and optimize after development.

CONCLUDING REMARKS

In order to solve the weak problems of low-level construction, information resource decentralization, information resources integration and sharing, and insufficient coordination ability between business systems, the paper builds up a long river management information system based on Internet plus, and improves basic information and resources sharing, and explores the conjunction between advanced technology and river and lake system. The river and lake management and protection system will truly achieve the informatization of water conservancy, and help the accurate supervision of rivers and lakes. However, the realization of the overall framework of intelligent operation of water conservancy informatization is a long process, which needs overall planning and step-by-step implementation. On the basis of the experience that can be popularized in the pilot, the standardization will be promoted, and then the optimization and personalized customization will be carried out step by step according to the characteristics of each application area. In the face of long-term river and lake management, the traditional work mode is no longer applicable. It drives the work of river and lake leader system by information technology, integrates the basic information and monitoring data of water conservancy and environmental protection departments, provides dynamic and real-time query, reporting and management services for the public, builds River and lake ecological linkage management system, and realizes the wisdom of river and lake leader system construction, It is of great significance to improve the water management system, ensure water safety and build a beautiful China.

References

1. Zhao Mingyan, Zhang shuantang, sun Mei, Li Jie. New ideas of river and lake protection and restoration in the new era: a case study of Regulations on river and lake protection and treatment in Hebei Province [J]. Research on governance modernization. 2020;36:91-96.
2. Regulations on the protection and administration of rivers and lakes (reservoirs) in Ledong Li Autonomous County [n]. Hainan Daily. 2020.
3. Huang Liang, Luo Hao, Xu Heng. Practice and thinking of water resources management and protection in Dongjiang River Basin [J]. Water conservancy planning and design. 2020;56-58.

4. Abebe Getahun, Mulugeta Wakjira, Dorothy Wanja Nyingi. Social, economic and management status of small-scale fisheries in Omo River Delta and Ethiopian side of Lake Turkana, southern Ethiopia [J]. Elsevier BV. 2020. https://bit.ly/2TEWLnK

5. Li Ang, Liu Dingxiang. Thoughts on the improvement of legislation of river lake system [J]. Water conservancy development research. 2020;20:9-11.

6. Shen Shiping, Lin Ping, Zhao Yanan, Xie Zhenping, Liu Yuan. Construction and thinking of Wuxi river head system integrated information platform [J]. Jiangsu water conservancy. 2020:25-31.

7. Zhao Hongbing. Research on long-term prevention and control path and method of illegal problems in rivers and lakes [J]. China water conservancy. 2020;19-22.

8. Li Fa Peng, Fu Jin Ding, Geng Si min. current situation and Countermeasures of shoreline management and protection of rivers and lakes in Gansu Province [J]. China water conservancy. 2020;33-35.

9. Gao Changling. Order No.2 issued by the chief River officer of Henan Province, deeply carrying out the "four chaos" action of rivers and lakes [J]. Resource guide. 2020;7.

10. Wang Zhenning. Analysis on the upgrading and improvement of decision support system of river head system in Anhui Province [J]. China water conservancy. 2020;34-36.

11. Guo Shanshan, Xing Yunpeng. Application of remote sensing technology in dynamic monitoring of rivers and lakes in Hebei Province [J]. Hebei water conservancy. 2020;33-37.

12. Guidance on strengthening river and lake management [J]. China water conservancy. 2014;5-6.

13. Sun Jichang, director of the construction and Management Department of the Ministry of water resources, interprets the guidance on strengthening river and lake management [J]. China water conservancy. 2014;7-8.

14. Ministry of water resources of the people's Republic of China. Guidance on strengthening the management of rivers and lakes [n]. China Water Conservancy journal. 2014.

15. Wang Hongxia, Liu Lu, Dan Weiguo. Problems and solutions of river and Lake Management in China [J]. Anhui Agricultural Sciences. 2012;40:1684-1686.

16. Hu Jin Xian. On Internet plus [J]. City road bridge and flood control in Qingpu River and lake long-term management work. 2019;200-203.

17. Liu Jingao, Fang Shenguang, Xu Jiejing, Huang Daizhong. Design of river and lake shoreline intelligent supervision scheme based on the system of river and lake leader: A case study of the river network area in the Pearl River Delta [J]. People's Pearl River. 2019;40:121-127.

18. Wang Zai Al, Lu Hui Zhu, Yao Ji Hua. Research and development of management information platform for four rivers and Dongting Lake [J]. Hunan water conservancy and hydropower. 2020;03:101-105.

19. Gao Guangzhi, Chen Fuli, Wang Jing, Wan Li, Zhu YONGYING. Focus on the construction of pollution source monitoring and management project [J]. Environmental protection. 2009;06:56-58.

20. Tang Wei, Tang Tao. Application of remote sensing technology in water quality online monitoring [J]. Journal of China Environmental Management Cadre College. 2007;04:83-85.

How to cite this article: Guosen C, Jin Z, Shubiao G, Kaikai L. Application of Water Conservancy Informatization in River and Lake Management. J Biomed Res Environ Sci. 2021 July 08; 2(7): 548-554. doi: 10.37871/jbres1275, Article ID: JBRES1275, Available at: https://www.jelsciences.com/articles/jbres1275.pdf