Application of GIS System and UAV Technology in the Work of River chief system

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Abstract. The main task of "River chief system" is protecting water resources, preventing water pollution, improving water environment and rehabilitating water ecology. It has a clear division of responsibility, coordinated and orderly, strict supervision and strong protection of rivers and lakes. It provides an institutional guarantee for maintaining healthy life of rivers and lakes and realizing sustainable use of them. This study is based on the aerial survey data of rivers in a county of Xinmi City, Henan Province, and the results of the river patrol, to study the combination of drone technology and static and real-time GIS systems to meet the requirements of the “River chief system” management work. It reflects the connotation of the river chief system and solves the problems in the actual work. Finally, based on this paper we want to provide an idea for improving the efficiency of the river management system.

1. Introduction

In November 2016, the General Office of the CPC Central Committee and the General Office of the State Council issued the "Opinions on Comprehensively Advancing the River chief system." This policy document pointed out that the full implementation of the River chief system is an inherent requirement for implementing the concept of green development and promoting the construction of ecological civilization. It is an important measures to maintain a healthy life in rivers and lakes \(^1\). The job of River chief system carried out basic investigations on the river and water conditions in the county and formed a file for the basic information of the river, the responsibility of the river, the system construction, and the governance standards. It is guided by problems and needs, and based on the "Xiumei River and Lake" as the standard. By solving outstanding problems, it puts forward countermeasures to improve the water environment quality of rivers and lakes, the water landscape on both sides of the river and the water culture of the river basin.

With the development of our social society, the river and lake ecology has been severely hit, and
the water quality has repeatedly deteriorated. The purpose of the river chief system work is to ensure that the river maintains a good ecological environment for “lucid waters and lush mountains” in a long run. In the past, the River chief system relied mainly on manpower. The collection of information in the river channel was mainly carried out through manual river surveys. The massive river information could not be accurately managed, the investigation period was long, the management level was insufficient and the field survey was often subject to weather factors. The impact is intermittent, the whole process is incoherent and the work efficiency is low. At the same time, in the expression of engineering, the one-dimensional text is limited to describe the problems that arise. The two-dimensional images can't reproduce the river environment well, and also can't directly reflect the river channel. The past works mostly use traditional paper to store file and there is a partial loss.

Secondly, under the current River chief system, the river chief is served by the party and government leaders at all levels. For the busy river chief, it is impossible to properly sort out the problems in the river without conducting inspections on the river and it is difficult to achieve all-round Normalized inspection and supervision [2]. According to the river chief system, those chiefs at all levels need to carry out regular inspections of river management, river-related projects, water pipelines, river cleaning, river sand mining, etc., in a timely manner to stop illegal activities within the scope of river management, and most rivers Multi-tasking, the process of patrolling the river is lengthy, and due to the different rivers in different regions of the river, some regional staff cannot reach and there is a blind spot. Therefore, based on this background, this paper studies the problems that arise in actual work relying on the work of the River chief system in Xinmi City, Henan Province. We use GIS technology and UAV technology to the actual management of the River chief system and facilitate the river chief to manage the river efficiently. Finally, we want to optimize the existing management model through scientific and reasonable technical means for practical work.

2. The application of GIS system and UAV technology in the work of river chief system
The static GIS management system is used to manage spatial data and describe spatial relationships, and to express the spatial distribution of geographic objects. Oblique photography is a new technology developed in the field of international surveying and mapping in recent years. It is a new aerial photography method for acquiring ground information, which changes the previous orthophotos that can only be taken from vertical angles. Limitations, intuitive display of features. Combining the static GIS management system with the oblique photography technology can well realize the data management under the river chief system work. It can also store the past paper storage files into the system for unified management, thereby improving the management efficiency of the river chief. The relationship between the static GIS system and the UAV system is shown in Figure 1.
During the implementation of the River chief system, it is necessary to conduct performance appraisal of the river chief and implement the accountability system of the river chief. One of the important assessment contents is the investigation of the river patrol. According to the previous patrolling mode, it is time-consuming and laborious for river chief to patrol the river personally. The UAV cruise technology is a technology that uses a UAV to carry sensors and uses real-time transmission means to transmit data to realize real-time cruising of the river. The real-time GIS system is an engine for real-time access, loading, space-time correlation and fusion computing of various dynamic information. It is the nerve center of the wisdom management of the River chief system. The acquisition, processing, sharing and distribution of the spatial and temporal dynamic information of the actual river channel becomes alive. The information link combines realistic rivers with digital rivers, providing water workers with a workspace that is inseparable from everyday activities. It is an upgrade to the static GIS system. This system relies on real-time data transmission, management and real-time analysis, with continuous generation, real-time dynamic update and other characteristics. With the continuous development and maturity of the Internet of Things and wireless sensing technology, the technology is developing in a fast, accurate and real-time direction. The relationship between the real-time GIS system and the UAV system is shown in Figure 2.

**Figure 1** Static GIS system

**Figure 2** Real-time GIS system
3. Example Application: A Case Study of the River Chang System in Xinmi City, Henan Province

The basic work carried out to further promote the River chief system, including the current river and lake management system, planning, rivers and lakes grading list, “one river and one file”, “one river and one policy” preparation task, river and lake monitoring, construction of information platform for River chief system. In this work of the River chief system in Xinmi City, Henan Province, after doing a basic investigation and water conditions in the county, in order to improve the content of “one river and one file”, the basic information of the river channel is formed into a file. At the same time based on the static management system of GIS system, oblique photograph technology of UAV, aerial survey image, a spatial data model with vector information is established. Using its intuitive advantage, the static GIS system is imported to form an electronic map. When building a database of managed objects, the three-dimensional model in the system is regulated. In this work of Xinmi City, Henan Province, we adopt physical singularization technology and manual reconstruction by 3Dmax software. It will form a hydraulic structure within the management scope to form an entity that can be selected and separated, and attach attributes to realize query statistics, analysis, etc. Features. Objects within the management system are given unique internal identities to enable access to managed objects. Through the model object query to get its corresponding attribute information, according to the attribute value or its scope, through the SQL (Structured Query Language) query operation, construct a logical expression that meets the query condition, and find the corresponding spatial data object in the 3D model. Thereby, cross-query of map space data and attribute data is realized.[5]

Based on this, in the process of actually operating the information management system, The chief combined with the oblique photography model to make corresponding decisions for the content that there are problems to propose corresponding solutions, and there is no reporting situation. Therefore, the result is convincing. The amount of image data acquired by this technology is much smaller than the amount of three-dimensional data received by real-time GIS technology, and the data format of the image can be shared using mature technology.

![Figure 3 singularized rear axle model](image)

In actual work, the effective carrying of IoT and sensor network information in the management of the River chief system requires the construction of a real-time 3D GIS system from the outside to the inside. This time, we use the data management system of Zhongketuxin for the inspection results of the UAV, the mission planning is done in advance so that the drone can perform fixed-point reconnaissance and regional reconnaissance according to the set route. It can realize the rapid retrieval and inspection of photos, videos, and orthophotos of drones, mark the various items found in the inspections, and quickly manage the inspection data. The technology can gradually replace manual inspections by virtue of its good maneuverability, strong timeliness, wide inspection scope and strong
ability to overcome weather factors. During the cruise process, timely detection and reporting of incidents can also be achieved. The remote sensing data returned from this cruise work is shown in Figure 3. During the cruise process, the floating garbage was found. The river chief understood the situation and dealt with it in time.

![Image](image1.png)

**Figure 4** UAV cruise remote sensing map

4. Technical advantage analysis

UAV oblique photograph is a kind of virtual reality technology based on image stitching to make 3D models. The most obvious feature is “film texture”, which solves the limitations and authenticity of traditional methods. Not only can it truly reflect the ground object, but also uses advanced positioning technology to match the detailed image and geographic information, and restore the river to a model in the virtual state.

Static GIS systems are based on public geolocation and have the ability to collect, manage, analyze, and output a variety of geospatial information. The system is driven by analytical models and has the ability of spatial comprehensive analysis and prediction. It can not only manage data but also combine and analyze spatial data and related attribute information to achieve an accurate and complete query of various data information modes. In the work of the River chief system, the static GIS system makes the management work more intuitive and rational and relies on the GIS system to manage and analyze the planning data, which enhances the rationality of the river chief in planning decision analysis.

The wisdom and water conservancy under informatization is more intelligent because of “the more information is known.” This information is ubiquitous and ubiquitous with people, things, and things. It can be calculated, reasoned, and holographically perceived. Big data itself is neither science nor technology. The concept of big data represents an information age, a way of thinking and a technological trend. [6]

Transfer the captured image data to the drone inspection result management system, which can automatically recognize the shooting time and superimpose it on the image map according to the position information, showing the trajectory of the drone flight, which is convenient for the river chief. Assessment of the river situation. At the same time, the video playback changes synchronously with the location of the aircraft on the map, making it easy to quickly confirm the location of the problem. Traditional static GIS data may not be updated once every half a year, while real-time GIS data is real-time and its data is more abundant. Compared with the past manual survey data, the river management data under the real-time GIS system is more intuitive and easier to read. It is possible to record the implementation of the management of the river chief in real time based on the periodic
image data of the UAV cruise shooting.

5. Conclusion

China has a vast territory and numerous rivers and lakes. With the development of economy society, human has more and more use and disturbance of river channels, which has had a major impact on the river's ecological environment.

In order to achieve sustainable use of rivers, ensure flood control of rivers, give full play to river functions, and fully implement the "River chief system", comprehensive management of rivers is extremely urgent. The UAV technology is equipped with sensors with real-time and high-efficiency characteristics. It performs panoramic monitoring and river management on rivers and surrounding environments, acquires river data, reduces man-made investigation workload, and improves river work efficiency. The combination of GIS system and river chief system work not only reduces the difficulty of storing data in the past but also realizes dynamic management of river channels from the perspective of informationization. At present, China's river chief system work is still in its infancy, software and hardware levels are uneven, real-time transmission, high-precision sensors, and other technologies need to be upgraded again to meet the requirements of the era of big data. This kind of technology can promote the promotion and application of the River chief system. But the unpredictable problems generated in the course of practice need further exploration and improvement, and it will strive to become a real weapon in the next step of River chief system work.

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