Big Data Grave Register Information Management System Outside Cemeteries Under Internet of Things

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Abstract. This article mainly aims at the cemetery outside the tomb positioning, MuZhuRen information collection difficult, compensation difficult problem, the government imposed using unmanned aerial vehicle (UAV) advanced positioning technology, control technology and the key technology of Internet of things – information collection and remote transmission technology and information technology such as collecting cemetery outside the tomb of the digital information, and statistical data to construct cemetery outside the tomb letter grave interest rate management system. So as to build a tomb information management system outside public cemeteries with statistical data. The research findings of this paper can construct a refined three-dimensional model for the high-resolution tomb images taken by UAV aerial photography technology and the specific data obtained by UAV aerial photogrammetry technology. The innovation of this paper is that the information collected by UAVs is transmitted to the mobile phone in real time, which is convenient for the government, cemetery managers and their family members to master the cemetery information. In this paper, through the literature analysis and data analysis of the research methods to build a tomb outside public cemeteries information management system.

Keywords: Big data · Tomb information management system · Unmanned aerial vehicle · Internet of Things

1 Introduction

Nowadays, with the rapid development of society, science and technology lead thetrend, and the communication between people is getting closer and closer. As a product of the high-tech era, big data is derived, "From the application level of understanding, the Internet of things refers to all the objects in the world are connected to a network, the formation of "Internet of things", and "Internet of things" and combined with the existing Internet, realizes the human society and the integration of the physical system, achieve more delicate and dynamic management of production and life "(Zhang 2010). "The Internet, telecommunication network and broadcasting network are the basis for the realization and development of the Internet of Things, and the Internet of Things is an

Y.-B. Lin et al. (Eds.): SGIoT 2021, LNICST 447, pp. 128–137, 2022.
https://doi.org/10.1007/978-3-031-20398-5_11

extension and expansion based on the three networks" (Qian and Wang 2012). Internet of Things technology is composed of sensor network, radio frequency tag reading device, bar code and two-dimensional code and other equipment. It is mainly applied in energy, broadband and medical treatment, while big data is mainly applied in genomics, military investigation, finance and medical treatment. This paper aims to build an information management system of tombs outside public cemeteries through big data. Due to the lack of unified management of tombs outside public cemeteries, some tombs are old and have been exposed to the wind and rain for a long time, resulting in blurred information such as tombs and tombstones, and even unknown unowned tombs. From the perspective of geographical location, the tombs outside public cemeteries are not only built on hills and other places, but also built on both sides of the main road, water sources and scenic spots. In the long run, digging for them may result in the collapse of subgrade, river dam and destruction of resources, thus causing incalculable losses. Based on the above reasons, it is necessary to collect the information of the tombs outside public cemeteries and construct the information management system of the tombs outside public cemeteries, which is beneficial to the management of the tombs outside public cemeteries. Due to the advantages of low cost, high surveying and mapping accuracy and wide application range, UAV aerial survey technology has been involved in forestry, land and resources survey, disaster information management, cadastral change and other fields, and its completion degree is high, so UAV is chosen to collect digital information of tombs outside public cemeteries. In order to better manage the tombs outside public cemeteries and maximize the use of land resources, it is necessary to build an information management system of tombs outside public cemeteries.

2 Literature Review

"The Internet of Things (IoT) is the underpinning of its technology. Internet of Things is the extension and application expansion of the Internet, which can realize the information interaction and connection between things and things, and between things and network" (Meng 2018). Therefore, the Internet of Things is closely related to the information management system technology in the context of big data. Management Information System originated in the United States in the late 1960s, and the word "management information system" became popular in 1968" (Wang 2007). In the 1980s, with the emergence of PC (personal computer), information management systems have been really developed, and they have been gradually introduced into China with the rapid progress of network technology. "In the second half of 1980s, the management information system was first applied to Financial software in China in the late 1980s with great success, and then it led to the development of other modules and made outstanding contributions to the management modernization of China" (Yu 2003). With the rapid development of global economy and the improvement of technology, people are welcoming the era of big data with Internet as a typical example, so "information management system" has a more mature explanation: "MIS is a system that takes people as the leading factor and uses computer hardware, software, network communication equipment and other office equipment to collect, transmit, process, store, update and maintain information" (Zhang and Lin 2011). However, what is big data? "Big data is the link that integrates the physical world, information space and human society" (Cheng et al. 2014). It is not difficult to find that big data is the man-machine integration of information collection and processing through computer, Internet, GIS, PS and other technologies, which was born to serve and facilitate human life.

The application of management information system by human beings involves all aspects and covers all fields. For example, in forestry, "GIS technology is used to manage forest resources of collective forests in southern mountainous areas of China, so as to obtain forest information sources timely and accurately for forestry managers and realize resource allocation and structure optimization" (Feng et al. 2001). Another example is the medical level, "Internet network technology is used to integrate the logistics management of medical high-value consumables and the information management of hospital equipment" (Yu and Yu 2006). In order to ensure the timely supply and safety of medical equipment, it also improves the cost performance and reduces the transportation cost. Another example is in the police resources, drug crime because of multiple factors to obtain drug-related intelligence is difficult, based on this public security border drug case intelligence information management system came into being. "Through the computer network management of drug case intelligence information, it can strengthen the collection, management and exchange of drug crime intelligence information in border security departments, and greatly improve the quality of border law enforcement" (Li 2015). Through the above examples, it is obvious that management information systems have been applied in many fields such as agriculture, medicine, law enforcement and othes, and have played an important role in our lives. However, most of the above management information systems adopt a single technical model, which is difficult to popularize all levels of society. Just like with the changes of the times, the burial governance outside public cemeteries has been widely concerned. For example, Article 14 of the Funeral Management Regulations of Guangxi Zhuang Autonomous Region was revised in 2021, and cremation was gradually implemented in areas with burial in the ground. Rural public welfare cemeteries can be set up in townships, towns and villages, and barren hills can be designated in remote mountainous areas to bury remains. It is advocated and encouraged to bury the remains without leaving tombs. It can be seen that some areas attach great importance to the management of tombs outside public cemeteries. At present, a perfect tomb information management system has not been established. Therefore, the author proposes that the establishment of a big data tomb management information system has high research and scientific value. However, how to establish the tomb management information system? Under the background of big data, "through the existing GPS satellite positioning and longitude and latitude coordinates, the specific location of the tomb can be accurately located, and with the help of on-site investigation and image collection, the relevant tomb information can be obtained in detail" (Ye et al. 2017). GPS satellite is used to locate the accurate position, and aerial modeling of UAV can calculate the tomb area after post-technical processing, which provides a basis for future government compensation. On the one hand, the establishment of Tomb Management Information System fills the loopholes in the field of funeral management information system, on the other hand, it is also conducive to efficiently, accurately and effectively alleviating the unreasonable burial phenomenon outside public cemeteries, facilitating the management of government departments and improving their work efficiency.

3 The Analysis of Tomb Information Management System Through Big Data

3.1 Data Collection of Tomb Information Management System

The tomb information management system of tombs outside public cemeteries is beneficial to the scientific management of tombs outside public cemeteries, but the construction of big data information management system needs to consider many factors comprehensively. However, the difficulties in the process of building the system lie in the determination of the location of the cemetery, how to measure the area of the cemetery, how to solve the unknown tomb encountered in the process of confirming the identity of the tomb owner, the address of the tomb owner before his death and the distance between the address and the cemetery. In view of these difficulties, what methods should be used to collect data? Currently, ecological cemeteries in China adopt GPS Position System, Management of cemeteries, while predecessors (Ye et al. 2017) also used GPS (Global Position System) and Satellite Positioning (see Fig. 1) when studying tombs outside public cemeteries. However, satellite positioning is limited by distance, weather, cloud cover and other factors, unless military satellites, it is difficult to take clear photos of cemeteries. The big data tomb information management system adopts UAV aerial survey. (Nan 2020) "UAV aerial survey can adopt UAV platform with multi-rotor and fixed wing, camera sensor equipped with single lens and multi-lens, small airborne radar and others, which is an advanced surveying and mapping technology for UAV survey". (Xu 2020) "UAV technology has the advantages such as flexibility, quick response, high resolution and wide range", and UAV aerial photography can generate a three-dimensional model for the cemetery, and accurately and stereoscopically display the location and morphology of the cemetery. However, the operation of UAV has professional requirements. Therefore, professional operators are needed to adjust the flight height according to the topography of the cemetery and the height of the crown on the basis of the suitable safe flight distance of the UAV. If the crown is blocked, the oblique shooting method can be adopted, and the area of the cemetery can be output according to the whole picture and the shape of the cemetery.

For the way of collecting the identity information related to the tomb owner in the tomb information management system. Ye et al. (2017) put forward that "the identity information of the tomb owner can be collected by means of on-site investigation images", and the information data of the tomb owner can be uniformly entered. However, if the identity information of the tomb owner is entered manually one by one, it is complicated and error-prone. Lin et al. (1998) said, "The existing business card omnipotent king can use smart phones to take business card images, quickly scan business card information and enter them into the system software". The collection of tombstone information can be transformed into the function of tombstone information collection by imitating the business card function, so that the tomb information collectors only need to use smart

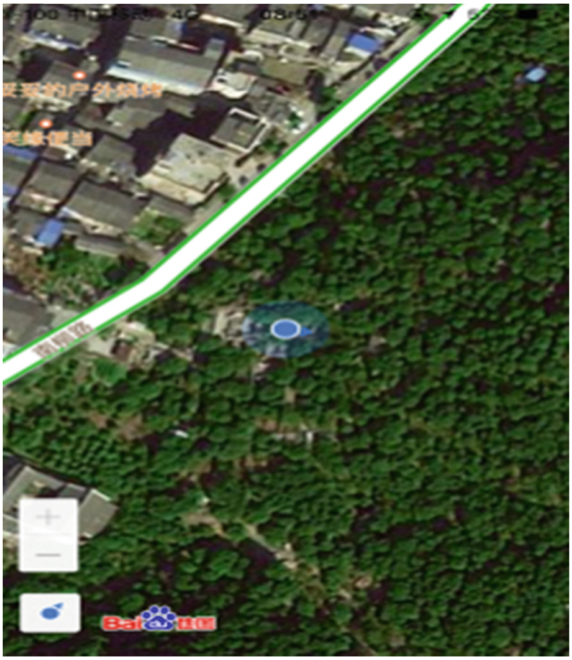

Fig. 1. Satellite map of tombs outside Daluoshan Cemetery in Wenzhou City. Data source: Investigation and survey by the team led by the researcher (photo taken on November 6, 2016)

phones to shoot tombstone information in the cemetery, and by shooting tombstones, the automatic entry of tomb information can be realized. Because some cemeteries were built for a long time, or the address of the descendants of the tomb owner is unknown, it is difficult to identify the tombstone information such as the name of the tomb owner, the date of tomstoning and the living address, so the relevant data can be collected by questionnaire survey in the surrounding areas, but some surrounding residents are newly moved residents, or because of their long history, the residents who know the information of the tomb owner have passed away and cannot be investigated. However, China has the custom of sweeping tomb and offering sacrifices in Tomb-Sweeping Day, so the identity information and address of the tomb owners and their descendants can be collected in Tomb-Sweeping Day. In addition, in the tomb information management system, the location of the tomb and the living address of the tomb owner, or the address of the descendants of the tomb owner can be added. In this way, through the distance formula between two points, the shortest distance between the cemetery and the address of the deceased or the descendants of the tomb owner can be calculated, and the radiation range of people building tombs here can be calculated as the diameter, so as to facilitate the government to grasp people's wishes to build cemeteries, thus determining the management scope and saving the budget amount of cemetery management and education and publicity.

3.2 Data Analysis of Tomb Information Management System

It is necessary to analyze the data of the information management system of tombs outside public cemeteries for building a scientific and reasonable information management system of tombs. Among them, the name of the tomb owner, the name and contact information of the descendants of the tomb owner are conducive to confirming the identity of the tomb owner and the kinship of the descendants, and provide subject information for the government to carry out expropriation compensation for legal cemeteries in different periods or the cost of dismantling illegal cemeteries. The living address of the tomb owner helps the government to communicate with the descendants of the tomb owner in time when managing the cemetery; the tomstoning season is conducive to catering to the concept and customs of the descendants of the tomb owner who pay attention to the time of erecting monuments and the choice of feng shui days; The tomstoning time is conducive to the government's legal management of cemeteries according to funeral laws and land management regulations in different periods; The latitude and longitude of the cemetery is beneficial for the descendants of the tomb owner, managers and the government to accurately find the location of the cemetery; Altitude is conducive to understanding the height of the cemetery; Photos around the tomb are convenient for the government to understand the surrounding situation of the cemetery, discover, manage and dismantle illegally built cemeteries in time, and also help the government to master the number of illegally built cemeteries, provide data reference for the government to publicize and educate the information management outside public cemeteries in the surrounding areas, and avoid the waste of human and financial resources; UAV shooting modeling is conducive to showing the whole picture of the cemetery in three dimensions; Shooting time is beneficial for the data collectors of tomb information to master the time of data collection, and take this time as the starting time point to update the tomb data information regularly.

3.2.1 Type of Tomb

Tombs are divided into five types: personal tomb, joint burial tomb, unknown, tomb before death, joint burial tomb + tomb before death (see Fig. 2). Personal tomb refers to the tomb where only one tomb owner is buried; Joint burial tomb refers to the tomb where two dead people are buried; Unknown tomb refers to the vague or unspecified information about the name, living address and burial date of the tomb owner on the tombstone; tomb before death refers to a tomb prepared in advance for the elderly with red fonts. Taking Daluo Mountain in Wenzhou as an example, according to the data in the figure, before 2017, the number of tombs in Daluo Mountain in Wenzhou was mostly joint tombs and unknown tombs. The confirmation of tomb types is beneficial for the government and Civil Affairs Bureau to scientifically control the area of tombs outside public cemeteries, and effectively prevent people from occupying land to build tombs on a large scale under the influence of the funeral concept of "magnificent burial".

3.2.2 Legitimate Construction of Tombs

With the aging of our country becoming more and more serious, the mortality rate is gradually rising. In China, burial is widely used, but land resources are limited, so tombs

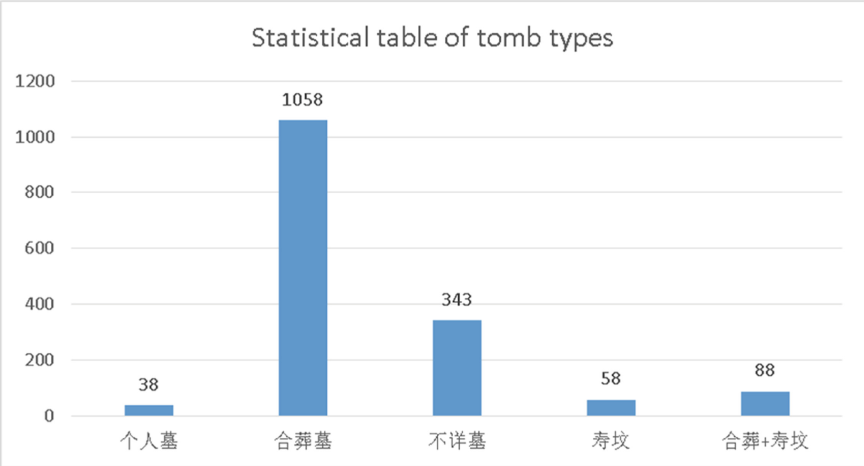

Fig. 2. Number of tomb types. Data source: Investigation and survey by the team led by the researcher

outside public cemeteries should be built according to law. The promulgation of laws and regulations on funeral and interment provides legal basis for the government to manage the construction of tombs outside public cemeteries. Ye et al. (2017) "Funeral management in China can be divided into three stages: from the founding of New China to February 7, 1985, from February 8, 1985, when the Interim Provisions of the State Council on Funeral Management came into effect to July 20, 1997, and from July 21, 1997, when the Regulations on Funeral Management came into effect". According to the survey data of tombs outside Daluoshan Cemetery (see Fig. 3), the number of tombs in this area has continued to increase in different periods. When the government implements the management of tombs outside public cemeteries, it can refer to the funeral laws and regulations of different periods and dismantle illegally built tombs; The cemetery that needs to be expropriated or requisitioned should be coordinated with the descendants of the tomb owner and compensated.

3.2.3 Regular Update of UAV Aerial Photography Data

In some areas of China, there is a funeral custom of "second burial". In this case, it involves the new location, orientation and area change of tombs. At the same time, due to the rising death rate caused by aging in China, many new cemeteries have appeared. Therefore, the data information entered into the system should be modified and updated in time. However, if aerial survey is re-conducted once a month, manpower and material resources will be wasted. Therefore, according to the number of local rebuilt and newly built cemeteries every year, the time of re-aerial survey can be determined to update the system data.

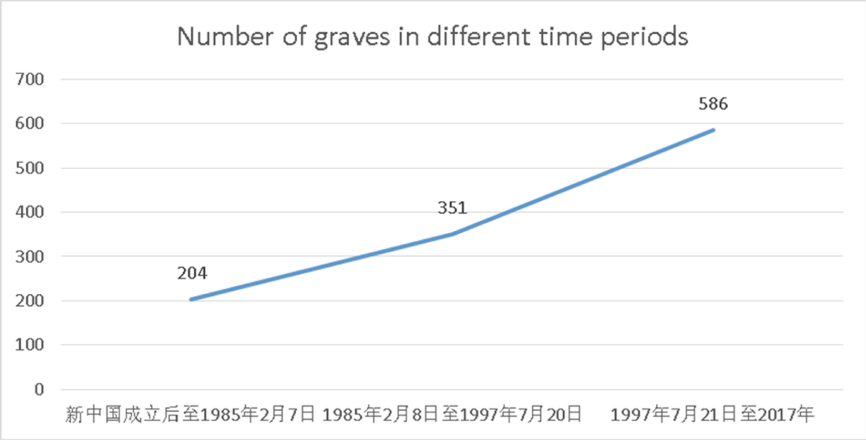

Fig. 3. Number of tombs in different time periods. Data source: Investigation and survey by the team led by the researcher

4 The Construction of Big Data Tomb Information Management System

In order to better manage the tombs outside public cemeteries, it is necessary to build a perfect big data tomb information management system. The big data tomb information management system is combined with modern science and technology, and adopts aerial photography of UAVs to collect data. Although UAV aerial photography has the function of tilting side photography, which avoids the shielding of canopy and bamboo to a certain extent, it is difficult for UAV aerial photography to shoot the whole picture in some cases because some canopy is too high or bamboo is too lush, and the flying height of UAV is limited. Li et al. (2021) "In order to solve the problems of poor GPS signals under the canopy, and the laid control points are easily blocked and can no longer be seen in photos, GPS-PPK technology is used to obtain three relatively accurate line elements (XS, YS, ZS) of the external orientation elements of the photography center at the photography moment, and use them to replace the line elements of the original POS data. On the basis of obtaining the accurate external orientation elements of the photography center by SFM (Structure from Motion) method, DSM is generated by dense matching, and the final result DOM is obtained by manual editing and orthophoto correction. Therefore, the collection of big data can adopt the combination of UAV and PPK technology, so as to build a perfect big data tomb information management system.

In order to facilitate the big data tomb information management system, such as tomb sweeping for descendants of tomb owners, cemetery administrators, relevant staff of Civil Affairs Bureau, etc., to find the cemetery to be searched as soon as possible in the cemetery area, the big data tomb information management system software can be combined with mobile phones. The descendants of the tomb owner sweep the tomb, the cemetery administrator, the relevant staff of the Civil Affairs Bureau, etc., only need to use smart phones to directly enter the tomb information management system, and through detailed analysis of the tomb data information, locate the corresponding cemetery quickly and accurately. Therefore, the construction of the tomb information management system for tombs outside public cemeteries consists of several sets of collected data, including the name of the tomb owner, the address of the tomb owner before his death, the season of erecting the tomb, the time of erecting the tomb, longitude and latitude, altitude, the surrounding of the tomb, the modeling of UAV shooting and the shooting time (Fig. 4).

Fig. 4. Data content table. Data source: Self-made by researchers

5 Conclusion

"For a long time, people have completely different views on burial outside public cemeteries. For the descendants of the tomb owner, they think that this is a continuation of the tradition of satisfying the wishes of the deceased and returning to the roots; But for the government, burial outside public cemeteries is a phenomenon that needs to be rectified" (Ye et al. 2017). The remediation method proposed in this paper is to accurately locate the longitude and latitude of tombs outside public cemeteries by using UAV aerial survey technology. The information of tomb owners and their families is obtained by using the unique customs of ancestor worship, family sacrifice and tomb sacrifice in Tomb-Sweeping Day or various regions. On some open hills in rural areas, tombs are often concentrated, so we can use the latitude and longitude of tombs to calculate the distance from cemeteries to nearby villages, so as to determine the management scope of the government. Using the information such as longitude and latitude of cemetery and cemetery area collected by UAVs, a cemetery information management system can be established by using big data technology, which is convenient for cemetery managers and the government to check the cemetery situation in real time. The innovation of this paper lies in the use of UAV shooting technology to establish a tomb information data management system including the information and household registration of the deceased, the information of their close relatives and non-close relatives, the type, area, longitude and latitude of the cemetery, and the tomstoning date of the tomb. The tomb information data management system is connected with the mobile phone, and the UAV aerial survey technology is combined with the geographical vegetation survey technology to establish a three-dimensional model of the tomb outside public cemeteries. And the combination of the Internet of Things and uAVs, "uAV-assisted communication technology of the

Internet of Things, help the Internet of Things to expand the existing network coverage, enhance the flexibility of the Topology of the Internet of Things" (Liu et al. 2020) to help us better collect tomb register information. But how to use UAV shooting and how to use UAV technology to build a refined three-dimensional model, If the technical content of this aspect is perfected, it will save the cost of collection and demolition for the government, effectively reduce the expenditure of government funds, improve the publicity efficiency of the government to the tombs outside public cemeteries, and better realize the land planning.

Acknowledgments. This work was supported by the Research Center for cultural construction and social governance in ethnic areas of Yulin Normal University (2019YJJD0003).

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