

The Application of "Internet plus Old Town Protection" in Old Town of Lijiang

Liping He^{1, a}, Ying Dong¹, Xueguang He¹, Bupei Li²

¹The World Cultural Heritage Old Town of Lijiang Protection Administration, Lijiang, Yunnan Province, China

²Zhejiang Supcon Information Co., Ltd, Hangzhou, Zhejiang Province, China

^a270521232@qq.com

Keywords: Old Town of Lijiang Protection, Internet Plus, the Internet of Things, Automated Management and Control

Abstract. Old Town of Lijiang is a famous historical and cultural city with higher comprehensive values. It incarnates the local history, culture and national customs and reflects the natural features of social progress at that time. It is the crystallization of human civilization. Meanwhile, Old Town of Lijiang is vulnerable and nonrenewable. Thus, Old Town of Lijiang Protection Administration attaches great importance to the protection of Lijiang. The Internet of Things technologies are adopted, in this vein, the method of "Internet plus Old Town Protection" is used to achieve fore-end data collection and back-end data analysis for the ultimate implementation of the management and protection of Old Town of Lijiang.

Introduction

The world cultural heritages are the rare and irreplaceable wealth confirmed by UNESCO and WHC, as well as the cultural relics and natural landscapes with Outstanding Universal Values recognized by all mankind [1]. They are nonrenewable resources with vulnerable and damageable features, which brought great difficulties in protecting Old Town of Lijiang. Thus, the conflicts between city development and the protection of Old Town actually trouble the administrators of Lijiang. "Internet Plus" is a new economic formation generated from the integrative development of Internet and traditional industries [2], which improves the creativity of traditional enterprises in virtue of new Internet technologies. Considered the world cultural heritage protection and Old Town management, Lijiang adopts the concept of "Internet Plus" to explore the new road of protection and development based on the actual needs, which provides a new updated management way for the World Cultural Heritage Old Town of Lijiang Protection Administration.

The Construction Background of this Project

In order to give support and guidance of technological innovation into full play during the economic and social development of Lijiang, the World Cultural Heritage Old Town of Lijiang Protection Administration placed "Digital Management and Application in Old Town of Lijiang Protection" as the key scientific research project. The project sets out to monitor the monitoring indexes concerning the heritage ontology as buildings, bridges, river channels, plazas, rare and old trees, noise, visitors flow, water quality and water flow, etc. In the meantime, it takes advantage of "Internet Plus" method [3] to conduct routine administration of Old Town of Lijiang protection as regards the management of electrical power monitoring and controlling, lighting controlling, video behavior analysis, personnel location, licensing and repairing.

Demand Analysis

The target of the project "Digital Management and Application in Old Town of Lijiang Protection" is to establish an integrated management platform for unified controlling and dispatching of

information resources. Adopting the new internet mode, the platform is an organic fusion of information based on all kinds of information systems in Old Town of Lijiang under a general technical standard. Afterwards, the high sharing of information resources in the whole network can be realized, which can found a big data base for intelligent Lijiang protection and management.

To establish a set of GIS (geography information system) based on Old Town of Lijiang: it will realize the delivery of geographical information of Lijiang over Internet based on geographical information technology.

To establish a set of information system conformed to the world culture heritage monitoring: through various monitoring technologies, the system will conduct early-warning management about heritage ontology, water, visitors flow and noise, etc.

To establish a set of information platform adapting to Old Town of Lijiang protection: the platform sets out from the angle of Old Town of Lijiang protection to build management systems as regards electrical power monitoring and controlling, lighting controlling, video behavior analysis, personnel location, licensing and repairing. It will provide technical support and decision support for Old Town of Lijiang protection.

System Implementation

Software Architecture.

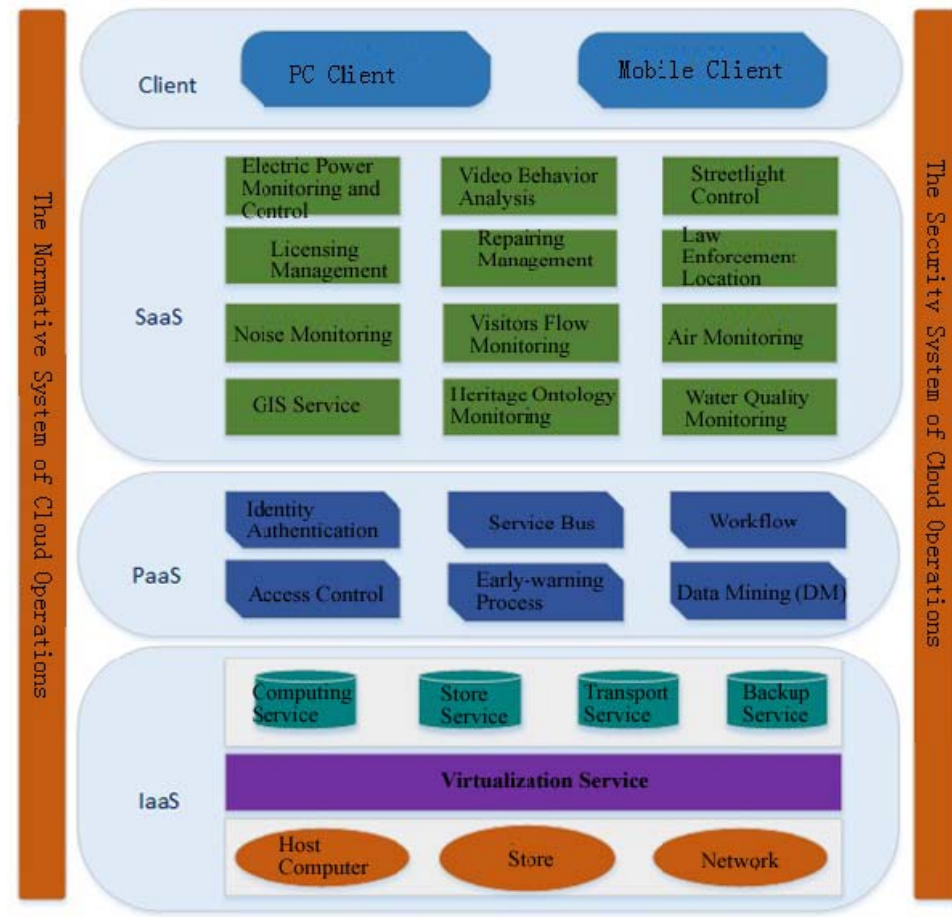


Figure1 Software Architecture

On account of the private cloud computing technology, software framework provides hardware-based services through virtualized technology integration server, store devices and network devices. By using cloud computing technology, the framework provides private cloud services for clients through the virtualized resource pool concentrating on internal storage, I/O equipment, computing power and storage.

PaaS (Platform as a Service) establishes a platform for background services. The platform deploys application design, application development and application test to help clients build diversified platform services and product customization requirements.

SaaS (Software as a Service) provides new situations for clients to obtain software services. Clients can directly get necessary software function from special platform over internet in accordance with certain SLA.

The representation of Clients can be divided into two parts as PC clients and mobile clients.

Network Architecture.

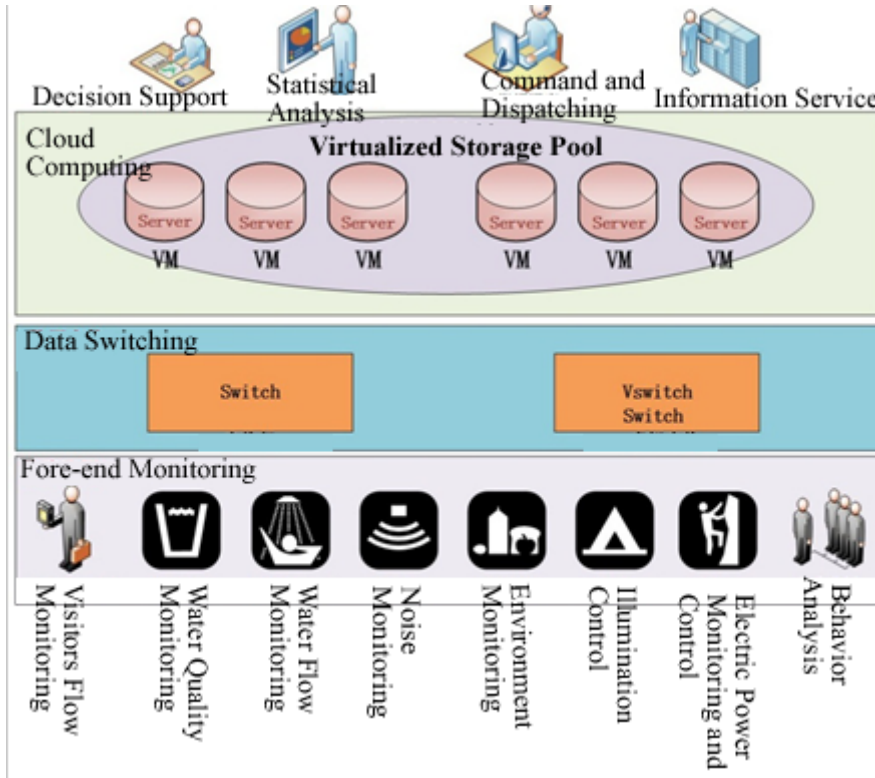


Figure 2 Network Architecture

Based on cloud computing [4], the network architecture can realize the fore-end monitoring and back-end data analysis. Monitoring the fore-end devices is conducted from the following aspects: visitors flow monitoring, water quality monitoring, water flow monitoring, noise monitoring, environment monitoring, illumination controlling and electrical power monitoring and control, which could link to data center switch through network; the data center server can establish private cloud through VM in order to compute the data collected in fore-end devices and form a network platform for unified management and exchange; besides, during data exchange, the switch can realize the function of quickly-addressing.

The Implementation of System Function. GIS Implementation Based on Web Server. GIS based on web server needs to offer data interface to clients, including basic information interface, functional interface, data interface and application interface. Functions that FIS can implement are listed as follows:

Map browsing function: the implementation of map enlargement, reduction and roam on Old Town of Lijiang, etc.

Map query function: functions covering query location, layer query and query property, etc.

Map analysis function: functions including the implementation of buffer area analysis by setting buffer radius, distance measurement between two points and area measurement among multiple points over GIS.

The Implementation of Heritage Protection. Old Town of Lijiang protection is mainly to monitor heritage ontology [5] which is the carrier of heritage concept. Old Town of Lijiang, a World Cultural Heritage, is a singleton or connection of building group with outstanding universal values in terms of various aspects as architectural style, uniform distribution or the landscape from the historical, art and

scientific angles. The Heritage ontology includes buildings, bridges, streets, plazas, river channels, waters, stores, and ancient and rare trees, etc. By the means of measurement, location, monitoring, investigation and registration, it is to implement the collection and record of information about heritage ontology.

There are many factors that can affect heritage ontology, including natural factors and human factors. Thus, the early-warming monitoring on the factors can better reduce the damage for heritage ontology. In this vein, we have collected fore-end data about air, temperature, rainfall, wind power, noise, water quality, water flow and visitors flow about Old Town of Lijiang through highly new technology, and then made the back-end data analysis, afterwards, provided early-warning. Finally, the function of early-warming can be really implemented.

The Implementation of Old Town Management. City management is an open, complex and huge network, concerning multi-dimension managements such as infrastructure, public service, public affairs and city protection, etc. Depended on the basic city information stream, the network sets out from practical application of Lijiang to create a mode of "Internet Plus" and management for its administration as regards the following aspects: electrical power monitoring and controlling, illumination controlling, circuit prevention of burglary, video behavior analysis, law-enforcement personnel location, licensing management and houses repairing management, etc.

By using the technology of automated power acquisition, electrical power monitoring management and controlling management can implement real-time electricity monitoring, remote meter reading, circuit load analysis, electricity abnormality warning and energy consumption and saving analysis for the stores in Old Town of Lijiang.

Illumination controlling management can implement automatic remote switch of street lamps and landscape lamps. The real-time information about the on-off state of the lamps, line voltage, electricity and electrical load can also be known through monitoring devices. Besides, the setting of equipped circuits' resistance value and the adding of line-terminal resistance detecting can also implement the prevention of burglary of public lighting circuit.

Human behaviors can reflect the event probability to a certain extent. Taking advantage of the intelligent analysis software to analyze cameras distributed all over the city, the video behavior analysis is able to acquire the probable issues about urban public securities. For example, once people gathered together, public affairs would easily happen; quick travel may cause accidents; stealing may possibly appear in surveyed area entrance; operators on duty may notice the reserved goods in time; parking detection can better solve disordered parking phenomena in Old Town of Lijiang.

Law-enforcement officer location management can send real-time location information of the officers to command center which is convenient for dispatching. Meanwhile, path query and boundary violation alarm can restrict the officers' behavior.

The licensing registration management and house repairing management can better supervise the stores operation and regulate business activities in Old Town of Lijiang.

Table 1 Setting Threshold Value for factors affecting Ontology

Number	Factors	Monitoring contents	Early-warning setting value	Reference standards
1	Air	PM2.5($\mu\text{g}/\text{m}^3$)	24h 75	GB3095-2012 Ambient Air Quality Standard
		($\text{mg}/\text{m}^3\text{h}$)Sulfur Dioxide	0.15	GB3095-2012 Ambient Air Quality Standard
2	Temperature	Air temperature($^{\circ}\text{C}$)	Early-warning of high temperatuer 35°C	Lijiang Meteorological Office of Yunnan Province
		Air Pressure(hPa)	720hPa	Lijiang Meteorological Office of Yunnan Province
3	Humidity	Humidity	70%	Lijiang Meteorological Office of Yunnan Province
4	Rainfall	Rainfall Probability	80%	Lijiang Meteorological Office of Yunnan Province

		Rainfall capacity	24h 25mm	Lijiang Meteorological Office of Yunnan Province
5	Wind power	Wind power (m/s)	Blue: 6-7 Orange: 8-9 Yellow: 10-11 Red:12	Lijiang Meteorological Office of Yunnan Province
6	Noise	Noise(dB)	Three-stage early warning:70-75 Two-stage early warning:75-80 First-stage early warning:80	Conventions Concerning Old Town of Lijiang Protection of Yunnan Province
7	Water quality	Turbidity(NTU)	Three-stage early warning:400 Two-stage early warning:500 First-stage early warning:600	GB13200-91 Water Quality-determination of Turbidity
		Dissolved oxygen(mg/L)	≤ 2	GB3838-2002Environmental Quality Standard for Surface Water of the People's Republic of China
		Conductivity(us/cm)	1500	GB5749-2006Relevant Standard Concerning Electric Conductivity in Hygienic Standard for Drinking Water
		PH value (dimensionless)	6-9	GB3838-2002 Environmental Quality Standard for Surface Water of the People's Republic of China
		Temperature($^{\circ}$ C)	Average maximum temperature rise per week \leq 1week Average maximum temperature drop per week \leq 2	Lijiang Meteorological Office of Yunnan Province
8	Water flow	Flow velocity(m/s)	< 0 > 1	Old Town of Lijiang Channel Administration Station of Yunnan Province
		Liquid level(m)	< 0.01 > 0.8	Old Town of Lijiang Channel Administration Station of Yunnan Province
9	Visitors flow	Current flow(man)	Three-stage early warning:11500 Two-stage early warning:16500 First-stage early warning:21500	LBT 034-2014Measures for the Administration of Carry Capacity of Scenic Area
		Total flow(man)	172000	LBT 034-2014 Measures for the Administration of Carry Capacity of Scenic Area

Conclusions

City management is a tedious and complex work. But with the application of "Internet Plus" method, Internet of Things technology and Big Data Analytics, daily operation state of Lijiang can be known in time, which provides decision support for city management. After operating the project for several months, a great deal of real-time data has been collected. First, the operation effectively resolved the issue about remote switch of lamps that the switching time would not change online at same time. Second, the real-time electricity consumption can be controlled. The technology of remote meter reading improved the work efficiency of Old Town of Lijiang Administration of Power Supply. Third, the video behavior analysis and visitors flow monitoring provided big data warning for Lijiang authority, escorting the city' s security. Fourth, water quality and water flow monitoring can acquire the information about real-time pollution of Old Town of Lijiang, providing data support for waters dispatching. Fifthly, through the monitoring of heritage ontology such as buildings, bridges, streets, plazas and ancient and rare trees, and the monitoring of man-made environment and natural environment that have affected the heritage ontology, a development road fit for Lijaing protection was explored. As a result, the World Cultural Heritage Old Town of Lijiang can receive effective protection and utilization.

References

- [1] WANG Shiren. The Recoded Conception and Practice of Cultural Heritage. China Building Industry Press. 2015.
- [2] YUAN Xi. The Integrative Development Road of Internet plus Traditional Industries. Posts and Telecom Press. 2015.
- [3] LI Keqiang. Report on the Work of the Government, the Twelfth National People' s Congress, 2015.
- [4] YAO Hongyu, TIAN Suning. Cloud Computing. The Systems Engineering in Big Data Period. Electronic Inductry Press. 2013.
- [5] CHENG Qikai, ZHOU Yaolin, DAI Yang. The Methods of the Classification and Organization of Intangible Cultural Heritage Based on Ontology. Journal of Information Resources Management, 2011, Volume 3 (Quarterly).
- [6] Convention Concerning the Protection of the World Cultural and Natural Heritage. UNESCO. 1972.