

# Data Visualization and Multimedia Application in Value Identification and Integrity Protection of Traditional Villages based on 3D Simulation

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## Abstract

*3d simulation and virtual reality landscape is the main form of digital city street performance, through the virtual system based on computer, the designer can construct design of multiple perspectives to feel personally on the scene. In this paper, the authors analyze the computer aided multimedia application in value identification and integrity protection of traditional villages based on 3D technology. In the protection of traditional villages, multimedia technology has great advantages; it can realize the permanent preservation of traditional village historical memory and landscape. On this basis, the author analyzes the value determination and cultural connotation of traditional villages, and points out that the protection of traditional villages should be systematic and comprehensive.*

**Keywords:** *Computer simulation, Multimedia application, Value identification, Traditional villages*

## 1. Introduction

The traditional village is the village which has the material and non-material cultural heritage, has a high historical, cultural, scientific, artistic, social and economic value of the village, but also a living village [1]. The village is not only the memory of farming civilization, but also the most important cultural heritage of the Chinese nation. Under the impact of modern civilization and globalization, China's traditional villages are dying out. It is the consensus of the whole society to protect this kind of non-renewable cultural heritage [2]. The protection and development of traditional villages is a long-term, complex, dynamic, huge work. The current stage of China's traditional village survey and filing is the first step to carry out protection work [3-4]. In the background of the current pace of urbanization is accelerating, especially for some of the dying, a typical and historic village rescue records, is one of the most urgent work. The traditional methods of village survey include text, sound recording, video recording, photography and so on, which can be used to record the village from multiple aspects.

To view technology as the representative of the information technology in the village records, the work provides a new thought and method for the traditional village census filing, the traditional village overall record possible [5]. Technology refers to the use of computer image and graphics processing technology, suitable for the computer representation and processing model in the actual street scenes and established the model to achieve real-time rendering of virtual scene based on technology to provide a platform for people to record and reproduce the street landscape [6]. Technology can be divided into two categories: 2D and 3D street reconstruction technique. The two-dimensional street to reproduce technologies include 360 degree panoramic image and multi view panoramic image based reconstruction technique based on the street; reconstruction of

three-dimensional streetscape mainly based on artificial modeling, based on precise modeling and 3D scene reconstruction technique based on a simplified view.

## 2. Computer 3D Simulation

### 2.1. Digital city and 3d landscape simulation

3d simulation and virtual reality landscape is the main form of digital city, digital city landscape 3 dimensional simulation using the principle of computer graphics and virtual reality technology, 3 dimensional modeling technology, GIS technology and database technology to achieve 3 dimensional city landscape reproduction, so as to achieve the purpose of information transmission, to meet the needs of users [7]. Virtual reality technology can provide strong support for the creation and experience of city street. The virtual city street system built on the computer, the designer can construct design of multiple perspectives to feel personally on the scene. In the process of roaming in the construction, environment, roads, squares and other design elements and program adjustment [8]. All of this is in the habit of three-dimensional space in real time, immersed in the creation of the designer's thinking will no longer be interrupted by waiting for a long time, creativity and inspiration will also be inspired. The 3D visual simulation technology, provides a communication channel between professionals and non professionals, the public can also query the project design, in line with the principle of public participation, they can even make recommendations on program design, the formation of a feedback mechanism in the street, effectively help the relevant departments to make decision.

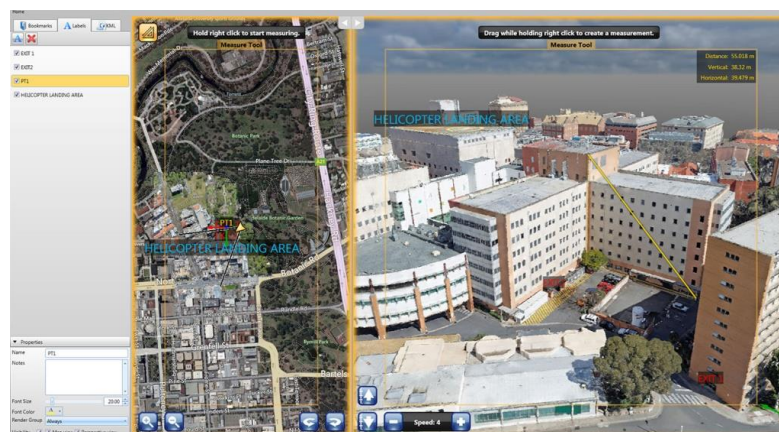


Figure 1. 3d GIS

3d landscape simulation of digital city is a city landscape visualization system based on the, which is based on the 3d geographic information database. Its function mainly has the following 4 aspects.

**1) information interaction:** The interaction of information is reflected in the system must have a friendly interface, so as to facilitate the user to communicate with the digital city 3 dimensional landscape simulation system. This kind of communication from the function package of two aspects, namely the user can query based on spatial features and attributes of the query based on the scene of the landscape, but also can carry out spatial relationship and attribute query, edit and so on.

**2) distribution:** Due to the nature of geographic information is distributed, and users in the digital city and information interaction, users are distributed to different departments and different geographical space, so this requires 3d digital city landscape simulation

must be distributed. The 3d landscape simulation of digital city should support the connection based on LAN and wan.

3) *real time browsing*: In the 3d landscape simulation of the digital city, the interaction between the user and the world of the 3 dimensional graphics is (quasi) real-time, which requires the rapid calculation and display ability of the 3 dimensional world.



Figure 2. Virtual reality

4) *landscape reproduction and landscape authenticity*: Virtual reality and 3 dimensional landscape simulation are the main forms of digital city. Through the powerful geographic information data processing function of the 3 dimensional landscape simulation system of digital city, we can use the standard geographic data to quickly and easily generate terrain scenes and urban landscape. Through the landscape reproduction, to achieve the digital city 3 dimensional visual simulation of the landscape output, and provide any angle, any view of the region.

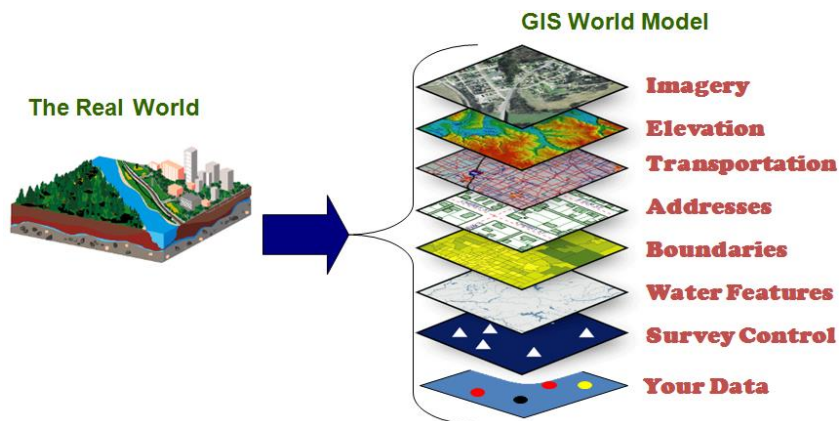


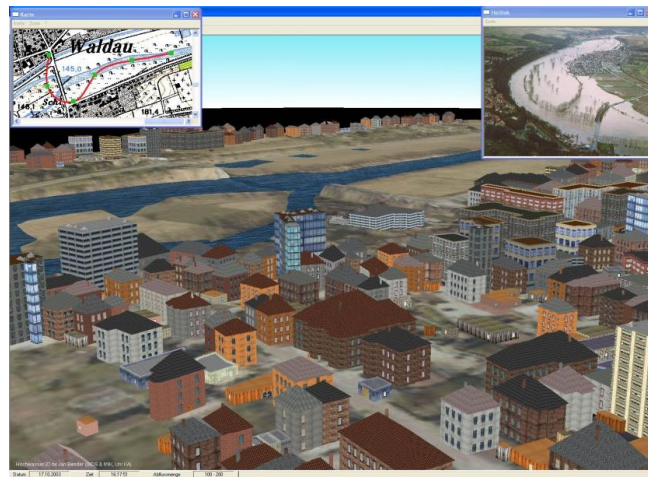
Figure 3. Geographic information database

## 2.2. 3D simulation technology

Currently popular on the market 4 3D API is OpenGL, Quick-Draw 3D (QD3D), JAVA 3D and Direct 3D.

- OpenGL, formerly known as GL of SGI, is widely used in MAC, PC and Unix development environment for Iris graphics system. Can be used for advanced CAD, simulation, and photo realistic gameplay. But OpenGL hardware demanding.

- QD3D was originally developed as a graphical extension of MAC OS and now includes support for Windows. Because QD3D is fully object-oriented, new object instances can inherit complex features (including illumination, geometry and texture, *etc.*), which simplifies the construction of 3D images. QD3D stores the scene and object information in a format called 3D metafile (3DMF). It is mainly used in graphic workstation, there are many restrictions on the use of microcomputer.
- JAVA 3D is the company SUN products, with the operating system independent features, and support for OpenGL API call, the advantage is to achieve 3D online publishing. When used in microcomputer, the construction of 3 dimensional scene is not flexible enough to meet the needs of the system.
- Microsoft Direct 3D is the newest member of the Direct family of X, is the middle layer of the three layer interface. Currently, the biggest limitation of Direct 3D can only be used for Windows platform. However, considering its speed characteristics and the functional requirements of digital community landscape simulation, we use the software package to build the system.



**Figure 4. Urban Simulation**

3d landscape simulation of digital city must have spatial geographic data, object model data and texture data.

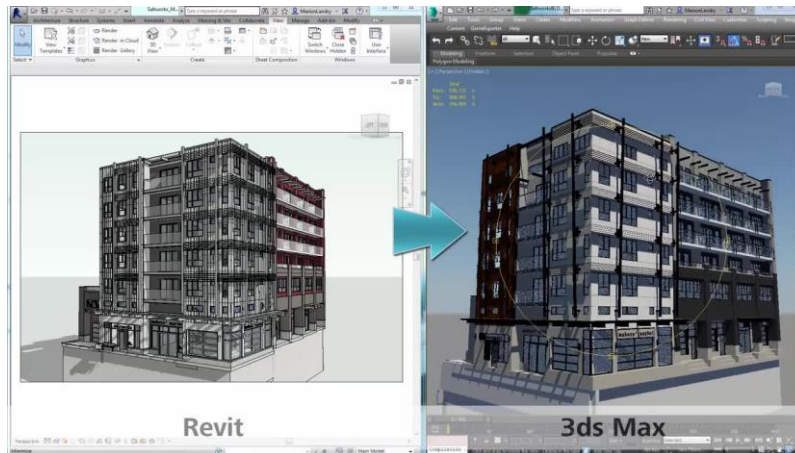
1) spatial geographic data acquisition: Spatial geographic data provides the geographic coordinates of the 3 dimensional landscape objects in the digital city, which is usually a large scale terrain data (such as: 1: 1000 topographic map) or field measurement data. The acquisition of these data can be obtained directly by using the existing terrain database, or by using the existing topographic map to obtain the vector data. For some special areas can be measured on the ground to obtain the required data.

2) data acquisition of landscape object model: The data of landscape object model is mainly obtained through 3 dimensional modeling method. At present, the entity modeling tools are 3DMAX, 3DStudio, MultiGen and so on. The acquisition of the attribute data of the landscape object is the acquisition of the attribute data while obtaining the object spatial data.

3) texture data acquisition: Are trees, flowers, lights, stop, bridges and buildings on the surface of the "true" structure using the texture mapping technology of digital city landscape in 3 dimensional simulation. The texture data is mainly composed of Bmp, Gif, Jpeg image files, the generation of texture mainly in the following two ways, one is



making tools such as Photoshop, Coreldraw, *etc.*, second is the use of programming methods for texture generation, such as using fractal technology generation.



**Figure 5. 3DMAX work flow**

Environmental factors refer to some of the visual elements and attributes that affect the environment, such as fog, background sky, light, *etc.* The simulation of these elements can improve the authenticity of the whole scene, and it is also one of the contents of digital city landscape simulation.

- 1) **background change:** There are two ways to change the background. First, the use of 2 dimensional image to do the background of the scene, but the background is static, can not be changed with the scene to make the corresponding changes, and the whole scene as a whole, resulting in an unreal feeling. The two is to treat the background as a far away landscape object, which is integrated with the whole 3D scene, and when the scene rotates, the background also changes accordingly. This kind of landscape object is realized by setting up a cylindrical geometry object and pasting the texture. We use second methods to achieve the background change.
- 2) **Realization of fog in weather elements:** The effect of fog is realized by mixing the color of the object and the color of the fog in a certain way. The commonly used method is based on the distance between the object and the viewpoint, and the farther the distance is, the deeper the two will be.
- 3) **environmental illumination:** In the 3D environment, the use of light can be more realistic representation of the geographical environment, the environment lighting effect by setting the light source to achieve. Commonly used light source is a light source, light and directional light and other types of light source has its own characteristics. In the process of the 3 dimensional simulation of the digital city, according to the actual environmental requirements, different types of light sources or combinations of types can be used to achieve very realistic simulation results.

In the 3 dimensional landscape simulation of digital city, the geometric modeling of geographical entities (such as houses, street lights, public facilities, *etc.*). At present, the popular modeling software mainly includes 3DMAX, 3D Studio, MultiGen Creator and so on. Using these software to carry on the geometry modeling of the object, it can display the spatial characteristics of the geographical entity realistically. These software model files need to be programmed or tools to format conversion, the conversion of the file data redundancy too much. In addition, the world coordinate system of each model is often inconsistent, resulting in system processing speed and workload increases. If the

landscape object is too many, often make the system running slowly, cannot meet the needs of real-time browsing. Another method is the entity model, this method is very suitable for some form of single geographic entities, while the model data file is small, file format can be controlled flexibly, but for complex geographic entities (such as some buildings with thousands of faces, this method is not very scientific.



Figure 6. Digital city landscape

### 3. The Application of Multimedia Technology in the Protection of Traditional Villages

#### 3.1. The superiority of multimedia in the protection of traditional villages

Street view image is a true representation of reality, through professional equipment to capture the street around the observer before and after, left and right, and under the direction of six scenery. Combined with the software system, the device can complete the image acquisition, processing, splicing and correction in real time. This panoramic image includes a vertical view of the level of field of view of 360 degrees and 180 degrees, like people standing in a street, can look around all positions, with visual structure characteristics, give a person a kind of feel personally on the scene, can display the picture of the village, so that the viewer to get near the village distance, immersion, the most direct visual perception. In image recording and broadcast the traditional village panorama has great advantages on the rescue records, protection and development.

- **Integrity:** In the protection of cultural heritage in China, the overall protection is the trend. The protection of traditional villages, but also in the field of cultural heritage protection of cultural heritage in china. The traditional village has both material and intangible cultural heritage, and in the villages, these two kinds of heritage are mutually integrated and interdependent. Between typical and historical value in the village, the historical remains of the relative position relationship has its inevitability and regularity, while the traditional method can only record the local video and photography, to present the spatial location relationship between the village culture elements. The spatial extension by street view technology, to three-dimensional, continuous, multi-faceted record in the village of intangible cultural heritage and intangible cultural heritage. The overall relationship, so many in the future may damage and annihilation remains to objectively record.



**Figure 7. level of 360 vision**

- **Dimensions:** From the village location, after hundreds or even thousands of years and adapt to the change and development of the environment, has become the organic part of the earth's land. Landscape pattern, landscape, slope gully Qianmo pond, the village ecosystem in a very delicate balance. The spatial form of the traditional village is also deeply influenced by the geomantic omen theory, which has obvious geomantic omen from the location of the village, the village shape structure, the building direction and so on. Street view technology can comprehensively and objectively show the village panorama, and record the absolute position of each element in the villages and the relative position of the structure, the order of the ethical relationship implied by the village heritage can be recorded.
- **Compatibility:** In the elements of the traditional village culture ecosystem, it includes the material culture as the surface culture and the immaterial culture as the core culture. Physical and cultural factors often as a carrier in the villages of clan authority, reflect the ethical relationship hierarchy and the pecking order through the village center layout. In the traditional villages, the material and cultural elements include village address, architecture, road, water system, public cultural space and so on. Traditional village also contains a large number of intangible cultural heritage elements, often through the village held in a fixed place folk activities and folk legends, stories, songs, skills, *etc.* Street view technology can integrate traditional census results, through post processing, will record a large number of scholars in the field of text, pictures, video and other information, embedded into the village street system, users in the street view at the same time, you can always choose one resource link located in the village, thus the dynamic, objective, live the state record makes many kinds of forms to be present.
- **Multi scale:** Technology not only can be used in the village street shooting, the interior public space, buildings can also be typical of villages in shooting. In the village census, you can select a representative of the ancestral temples, stage, celebrities, gatehouse, college, oil mill, papermaking workshop, ceramic workshops, stithy internal shooting, which reflects the spatial sequence in the traditional village "street - group - Courtyard -- building". During the continuation of "public space -- semi public space, private space gradient. Street view can also and low altitude remote sensing, aerial drones and other technologies, the formation of a greater level of multi-scale record the whole village
- **Objectivity:** Each traditional village covers a wide range of matters, its form of expression, geographical location, cultural connotations, such as a strong difference. The traditional photography and video *etc.*, often resulting in census workers and the subjective feelings of the photographer, may appear on the village matters landscaping or involuntary distortions, and shooting results is also often

associated with the photographer and the level of technology, it is difficult to objectively present. The street can be standardized for the filming process by specifying the shooting line, unified shooting equipment, equipment adjustment bracket height etc., subjective effects to maximize the elimination of shooting results. Most of the village landscape, street view can objectively and accurately record.



**Figure 8. The traditional village**

### **3.2. Application of simulation technology in the protection of traditional villages**

In the traditional village survey and protection, compared with the traditional methods of recording technology, has great superiority, carpet records of typical traditional villages through the digital way, can realize the building of China's traditional village from the new perspective, an important role for further protection and development work. Text, image, video and so on are the traditional methods used in the field of cultural heritage protection, the importance of these methods is self-evident, and has played a huge role in many areas, including the protection of traditional villages. The introduction of technology, is an effective way to expand the traditional record. Compared with traditional methods, comprehensive and intuitive, true record of village all the details will save the village panorama glance down, as all levels of government and research institutions of the important historical archives and research data. The camera and photography, compared to street shooting requirements for operator low, usually through a short time training, you can master the street collection equipment. Under the guidance of experts in the field, in accordance with the provisions of the route for a visit, you can complete a complete collection of villages. And the results can be optimized by post-processing. The results show that the image is stable and easy to popularize. The shooting path planning is the decisive factor for street collection is effective or not. Combined with the actual work, for a complete village street shooting path should go through the following:

- The periphery of a village: mountains and rivers around a village; fields and crops; forest areas; characteristic landforms.
- Village public space: bridge; infrastructure
- The main street of a village: the road to and from the village; the main road; the main commercial street; a street with a typical folk belief; a street leading to public space.
- The main building: ancestral temple village;; stage; celebrities; gate; college; oil; paper mill; bean curd workshop; dyeing; ceramic workshops; *etc.*
- The main object of the village: stone; stone; wells; dam; wharf; trees



- Typical representative of the buildings and places, should be carried out within the shooting.

The construction of the traditional village database is one of the necessary means for the protection of traditional villages, traditional villages to achieve a permanent preservation of historical memory and landscape, to provide intellectual support for government decision-making, provide an important resource for village protection and development research in the field of scholars. The traditional village in the database including text, pictures, sound, video and other multimedia data at the same time, the street should also become one of the important basic data of traditional village database. The traditional village database to create a large number of data by means of information for effective management of traditional village census, and is convenient for users to search, to avoid duplication of tedious crushing, save a lot of manpower, material resources, not only to achieve the purpose of protection, and to study and research, the inheritance and development of the role.

#### **4. Value Identification and Cultural Connotation of Traditional Village**

The cultural connotation of traditional villages mainly embodies the following three aspects. First, the existing traditional architectural style integrity. That should have the scale and the number of traditional buildings in the village, and the history of cultural relics and buildings concentrated layout is compact, the land area of protected areas with a total of more than 70% buildings; form, height, volume, house building roof, walls, doors and windows to keep the basic color the characteristics of local style and traditional style. Two is the village location and pattern to maintain the traditional characteristics. Also the evolution and development is basically a continuation of the village was built in the geomancy location feature, still embodies the harmonious relationship between human being and nature, contains the ancient Chinese philosophy of heaven and earth, to a certain extent reflects the architectural geomantic theory, and the Confucian etiquette norms and ethics; all kinds of building layout, road network pattern of village generally maintain a traditional spatial structure, spatial texture and spatial morphology. The three is the inheritance of intangible cultural heritage. The village is still maintains the traditional mode of production and life full of vitality and fresh living form, and relying on the traditional style and form to create in the past to multiply in sound, image and performance skills, and mouth generation as cultural chain and the continuation of the oral culture, culture and other cultural type and comprehensive culture etc.. Living heritage must be owned by the state and the relevant departments of the provincial intangible cultural heritage inheritors.

Assessment of traditional villages, as assessment units of cultural relics protection of historical and cultural cities and towns and villages, make it obtain the corresponding legal status or administrative status, and become the object of protection, are the need of legislative protection and administrative management based on it all the objects should be set up the legal requirements and evaluation criteria, but also must be approved by the relevant administrative authority announced. Without the approval of the authorized administrative organs, not named in the cultural relics protection units at all levels, historical and cultural city town village, traditional villages, naturally do not have the law, regulations, rules and policies to protect the status of. Because of this, in order to guide and standardize the evaluation, definition, registration and protection of traditional villages, we should set up the evaluation index system of traditional villages. According to its historical and cultural connotation, the evaluation of traditional village is divided into three components:

(1) evaluation index of traditional villages. Including the traditional construction of the main focus on the construction of the age, the type of construction, style features, land

area, accounting for the proportion of the total land area of protected areas, the overall level of protection.

(2) village location and pattern evaluation index. Including the construction of the village, the historical environment factors, the degree of preservation of the traditional pattern, the coordination with the natural ecological environment, the typical traditional culture, national culture, regional cultural characteristics.

(3) the evaluation index of intangible cultural heritage. Including intangible cultural heritage type, level, mode of transmission, the scale of activities, representative inheritors.

As a traditional village assessment index system, also to the three major elements of each quantitative analysis and qualitative analysis, from the traditional culture to its context, evaluation being quantity, integrity, and historical value, scientific value, artistic value. With the help of the traditional village assessment index system, not only can unify the traditional village evaluation, defining standard, make it more scientific and fair, and can effectively guide the evaluation and protection of traditional village development. The traditional village belongs to the cultural heritage, which is a kind of non renewable resources. Whether ancient or modern village location and change, the overall pattern of system, all kinds of traditional streets, buildings and facilities, as well as its interdependent nature landscape and environment and so on, are full of long past days remains, leaves us precious wealth of information", a live witness of the history of interpretation. These heritage resources integration essence of excellent traditional culture, reflects the construction productivity level, political environment, economic status, ideas, ways of thinking, ethics, etiquette culture, social values, aesthetic art, building materials and technology, management concept and mode, once destroyed, will no longer be lost. Non renewable nature of heritage resources, but also to protect the authenticity of cultural heritage has become essential. The purpose of this study is to promote the protection and development of traditional villages. Only in the special form and characteristics of culture they have in-depth understanding of the grasp of the premise, to establish the scientific and reasonable ideas, take the protection method and corresponding protection measures to obtain effective results, go or not less detours. The development of the protection of traditional villages in China has just started, but also the development in the transition of economy and society and accelerating the urbanization, in-depth study of the concept of traditional villages, traditional villages to explore the cultural connotation, for the implementation of Scientific Outlook on Development, follow the objective law, the heritage of farming civilization and economic and social development and a harmonious win-win situation, simultaneously.

## 5. Conclusions

As the existence of the traditional village, which is different from the material cultural heritage and intangible cultural heritage, it has its unique connotation and manifestation. It is not only a place for villagers' activities and historical remains, but also a substantial representation of various folk customs and folk beliefs. Therefore, the protection of traditional villages should be systematic and comprehensive, while retaining its historical remains to the maximum, but also do a good job of carpet census and digital records, for the village on the verge of a "backup". In the face of the trend of globalization and urbanization, it is of great historical significance to record and retain the soil of the root system of the Chinese nation, and to keep the permanent record by means of digital technology. The image data for the protection of traditional village street planning, protection and restoration scheme of scientific decision-making and protection engineering practice and scientific research achievements, plays an important role, but also opens up a new way for the protection of traditional villages and development.

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## References

- [1] P. Tassinari and D. Torreggiani, "The FarmBuiLD model (farm building landscape design): First definition of parametric tools", *Journal of Cultural Heritage*, vol.12, (2011), pp. 485-493.
- [2] I. A. Kapetanakis and D. Kolokotsa, "Parametric analysis and assessment of the photovoltaics' landscape integration: Technical and legal aspects", *Renewable Energy*, vol.67, (2014), pp. 207-214.
- [3] W. Suyoto and A. Indraprastha, "Parametric Approach as a Tool for Decision-making in Planning and Design Process. Case study: Office Tower in Kebayoran Lama", *Procedia - Social and Behavioral Sciences*, vol.184, (2015), pp. 328-337.
- [4] J. Choi, "Structural and parametric design of fuzzy inference systems using hierarchical fair competition-based parallel genetic algorithms and information granulation", *International Journal of Approximate Reasoning*, vol.49, (2008), pp. 631-648.
- [5] R. E. Skelton and F. Fraternali, "Minimum mass design of tensegrity bridges with parametric architecture and multiscale complexity", *Mechanics Research Communications*, vol.58, (2014), pp. 124-132.
- [6] S. Yasmin and I. Said, "Knowledge Integration between Planning and Landscape Architecture in Contributing to a Better Open Space", *Procedia - Social and Behavioral Sciences*, vol.170, (2015), pp. 545-556.
- [7] B. Jankowski, "Functional Assessment of BIM Methodology Based on Implementation in Design and Construction Company", *Procedia Engineering*, vol.111, (2015), pp. 351-355.
- [8] C. Tagliafierro and M. Boeri, "Stated preference methods and landscape ecology indicators: An example of transdisciplinarity in landscape economic valuation", *Ecological Economics*, vol.27, (2016), pp. 11-22.

