Application Research of Public Participation Platform for Urban Planning Management Based on Panoramic Technology

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Abstract: The creation of a public participation platform for urban planning based on panoramic technology by combining CSS and THREEJS on the Web end provides an effective channel for the public to participate in urban planning. Panoramic technology is a new type of streaming media, it highly restores the planned content through the virtual simulation, panoramic technology could deepen the public understanding of the content of the plan, it also reduced the learning cost of public participation in planning due to the professionalism of planning. Through the mongo DB-based database, the planning and comment data can be effectively managed for the auxiliary decision-making of urban planning, and the democratic and scientific nature of urban planning can be improved.

1. Introduction
In the report of the 19th national congress of the communist party of China, the Chinese general secretary Xi Jinping said: “we are going to build a pattern of social governance that is jointly built, jointly governed and Shared by all, We will strengthen the establishment of a social governance system, improve the social governance system featuring party leadership, government responsibility, public participation, and the guarantee of the rule of law, and raise the level of socialization, legalization, intellectualization, and specialization of social governance”. At the same time, the report of the 19th national congress of the communist party of China puts forward that the major social contradiction has been transformed into the contradiction between the people's growing need for a better life and unbalanced and inadequate development [1].

2. The Importance of Establishing Public Participation Platform in Urban Planning.

2.1. The Analysis of Public Participation in Urban Planning
In the China urban and rural planning law, the public participation mechanism of urban planning was first established, the planning procedure proposed "government organization, expert leadership, departmental cooperation and public participation" [2]. The urban planning law stipulates: "overall urban planning..., the feasibility study meeting, hearing or other ways should be put forward to solicit public opinions”. However, in the actual urban planning, public participation usually excluded in the planning preparation. The public suggestion was not contained in the previous planning preparation system, and public participation was limited, which led to public participation weak possibility. However, the urban planning approval stages in the form of "national approval", "hierarchical approval" and internal closed examination completely separates the public and social supervision from the approval
system, which leads to almost no public discourse power in the urban planning preparation [3]. As the public is excluded from the urban planning, the public's awareness of urban planning is generally low. Meanwhile, the professionalism of planning directly causes the cost of active participation in public perception is greater than the benefit gained from participation, resulting public participation is low enthusiasm and indifference [4]. In the all kinds of planning, the primary traditional methods of public participation include interview, questionnaire, posters, it leads to the lack of breadth and depth of public participation. The rise of elitism leads to public participation lack of substantive procedures and formalism [5].

2.2. The Necessity of Establishing Public Participation Platform of Urban Planning under the Background of New Era

With the establishment of the department of natural resources, China government establishment of spatial planning. The urban planning is no longer a relatively independent planning system, becomes the special planning under the space planning, urban planning under the new system pays more attention to the coordination with other planning and comprehensive control indicators. In the new stage, giving full play to the positive role of public participation in the planning and implementation process, establishing a good decentralization mechanism and formulating a reasonable public participation policy will help improve the democratic of planning decision-making, the efficiency of administrative power. The exercise in power requires a platform and channel into communication, including the concentration and accumulation of professional knowledge, inherent willingness and achievement requirements. The policies stipulated the specific berthing position of power. As the individuals or team symbols, the public should not be dismembered and changed by the power order but should be used as symbols of different implied meanings, carefully weave in the process of urban planning according to a complete guarantee mode [6]. In the process of planning, simplifying the administrative procedures, found the conflict in advance with the public participation, prompting the demotion or reduce conflict, conflict to protect this legal, effective and efficient planning is critical for major projects, informal can participate in the program before the formal decision-making process or to perform at the same time. In order to ensure the public acceptance and willingness to participate in it, governments and executive departments must bring with the real influence to the public and use informal public participation procedures as a tool of the reduction conflicts [7]. Therefore, urban planning needs a reasonable and effective platform for public participation. As an informal participation procedure, it can reduce conflicts in the process of urban planning implementation, provide a strong guarantee of the implementation of major planning projects, reduce administrative costs and improve administrative efficiency. As the scheme will affect the property rights and other related rights of the public, the applicants and stakeholders of the planning project should have the opportunity to present and be considered [8]. Therefore, the public as stakeholders also have right to participate in the work of urban planning.

3. Analysis of Public Participation and Application of Panorama Technology

3.1. Research Status of Panorama Technology Application

Comparing with the traditional scene technology, Panorama technology as a new rich media technology better restores the real scene, with better interaction. Put the Panorama technology into the public participation in urban planning through building the public participation platform of panoramic urban planning and using the virtual simulation of urban construction with panorama technology, the sense of substitution in interactive platform is enhanced. Through highly simulated interactive experience, the public can be motivated to participate in planning decisions. At present, panorama technology is applied for a wide range of management and planning fields. In existing literature research, Weiguang Shen combined panorama technology with 3DGIS and applied it to the special environment of coal mine roadway. Panorama technology enables users to browse the distribution, status and structure of coal mine roadway with computers and other related equipment and apply it to safety training, emergency rescue and other aspects [9]. Yinan Sun and some other researcher made the panoramic technology be used in the landscape evaluation, making a high simulation of scene and landscape through the panoramic view of VR technique based on improvement in SBE method and SD method were used to
construct the rural landscape visual evaluation model, to study the rural landscape visual evaluation and landscape element preference, and to apply the new technology in the field of landscape architecture [10]. In the field of planning, Zhang Qian [11], Ren Chao and others [12] explored the application of panorama technology. They applied panorama technology to urban planning and construction, then used panorama technology to highly restore urban information and conduct 3D modeling on urban planning, construction, governance and operation. Xu Ronghan and others [13] combined the DEM (digital elevation model) in GIS with the 3D system software 3DMAX for modeling, embedded the 3D model on the DEM after planning to build the virtual scene of planning, and used it to judge the rationality of land consolidation planning. By combining 3DMAX and Sky Line from Li Xiaoyan and others [14]. Constructed a simulation display platform for the general planning of land use, which was used for public participation in the preparation of the general planning of land use. Although panorama technology is widely used in various fields, the using cost and learning cost of the virtual simulation design platform for public participation in existing studies are expensive, which is not conducive to the promotion among the public.

3.2. Features of Panorama Technology

3.2.1. High simulation. Compared with traditional multimedia technology, panorama technology can restore scenes of a high degree. Using panoramic technology simulation and virtual display of planning content, compared with the traditional method of planning graphic display, it can be displayed on the 360 ° views objects of virtual simulation and provides higher degree of reduction and immersion experience for the display object. Panorama technology is used to display the planning objects, which enhances the public's sense of experience when viewing the planning.

3.2.2. Strong interactivity. Panorama technology has better interactivity. The traditional multimedia display technology in the interactive experience is too single, it can only show images of interacting objects specified with the poorer interactivity. Because the panoramic technology is conducted on 360 ° views generated, so can get on scene interaction function range greater operating experience more freedom. VR (virtual reality) technology can bring immersive interactive experience in the public.

3.2.3. Lower implementation costs. Compared with other virtual simulation technologies, panorama technology does not need a specific development platform. It can achieve the effect of virtual simulation reality of picture stitching and projection transformation. It can be realized on the web side of HTML protocol without the need of a complex SDK (Software Development Kit). It directly leads to the lower development costs and shorter development cycles.

3.2.4. Lower cost of use. Panorama technology can be used on the web side of the browser of the network terminal without to install a complex app (Application) due to the low development threshold. Therefore, the public can participate in the planning process of panorama platform without specific learning.

4. Technical Analysis of Urban Planning Web Panorama Public Participation Platform

With the development of computer technology, panorama technology has been fully developed. For panorama splicing algorithm, image fusion algorithm has a variety of researches, due to the different characteristics of each of the panoramic realization technology, this paper selected the most widely methods in panorama technology such as SIFT features extraction method (Scale – invariant feature transform), estimate the homographic matrix, Reinhard color fusion method as the examples, analyses the technique route about the technology in the implementation of the public participation in urban planning.

4.1. Panoramic Image Acquisition
The panorama can be generated by a panoramic camera and a photographic device with a fisheye or a wide-angle lens, or a partial image can be acquired by a common photographic device, and a panoramic image can be generated by a panoramic splicing technique. Directly shooting a panorama of a panoramic
device is simpler than generating a panorama of stitching. It does not require complicated modeling and graphic stitching correction, but the cost of the shooting device is high, so it cannot be popularized. Therefore, the current mainstream panorama shooting, the method is to generate a panorama by image stitching technique. For most urban planning renderings, the 3D model of the city can be used to capture the 3D model through the analog camera in 3DMAX. The commonly used method is to simulate the 3D model by simulating the fisheye wide-angle camera with the V-Ray plug-in in 3DMAX. Set the camera parameter mode to Spherical, Override FOV to 360, and the aspect ratio to 2:1. Select the appropriate rendering angle to directly render the spherical panorama of the 3D virtual scene. Image stitching tools such as Microsoft ICE, PTGui, and Hugin transform each other between other projection methods, and select the appropriate projection according to the different methods of rendering the panorama.

4.2. The Projection Transformation of Panorama
Panorama is usually through simulation of the fisheye lens, wide-angle lens image distortion by projection transformation in horizontal direction with 360 °, in vertical direction has a certain angle of view, close to half and then capture the wide Angle of view, to generate panorama, panoramic view of the common way of projection are: spherical projection, cylindrical projection and cube projection. Spherical projection is to put the longitude and latitude coordinates of the sphere corresponding to the horizontal and vertical coordinates into a grid about twice as high as wide, and stretch the north and south poles to the upper and lower edges of the grid through stretching transformation, so as to achieve the horizontal and vertical 360 panorama. Cylindrical projection compared with spherical projection, when the target is close to the north and south poles for the longitudinal tensile, due to the top and bottom of the grid without horizontal line, the poles will produce infinite longitudinal tensile phenomenon, therefore is not suitable for cylindrical projection with larger images of the vertical Angle of view, but compared with the linear projection can more accurate to keep the target size, is a traditional swing lens type standard panoramic camera projection method. The cube projection is a 360 panorama of the horizontal and vertical directions by joining the front, back, top, bottom, left and right six faces into an enclosed space.

4.3. Mosaic of Panoramic City Planning Images
After the projection transformation of the panorama is completed, the feature points of the image are first extracted form panorama splicing. The extraction of the feature points is essentially a condition for matching the pictures in the partial picture information to determine whether it has the characteristics as a feature. The method is SIFT feature extraction (Scale-invariant feature transform), and the feature conversion is completed under the condition of constant scale. The SIFT algorithm finds feature points by Gaussian blur (convolution of local image and Gaussian filter) at different scales to obtain Gaussian differences (Do G, Difference of Gaussians) and local extremum (Local Extrema).

The convolution expression formula for the local image I(x, y) and the Gaussian filter G(x, y, σ):

\[ L(x, y, a) = G(x, y, \sigma) \otimes I(x, y) \quad (1) \]

\[ G(x, y, \sigma) = \frac{1}{2\pi\sigma^2} e^{-\frac{(x^2+y^2)}{2\sigma^2}} \quad (2) \]

Formula: \( \otimes \) is expressed as a convolution operation, \( \sigma \) is expressed as a scale space factor.
The Gaussian difference operation expression is:
The dog operation formula:

\[ D(x, y, \sigma) = (G(x, y, k\sigma) - G(x, y, \sigma)) \times I(x, y) = L(x, y, k\sigma) - L(x, y, \sigma) \quad (3) \]

The local extremum feature points positioning formula:

\[ D(X) = D + \frac{aD^T}{ax} - X + \frac{1}{2}X^T \frac{a^2D}{ax^2} X \quad (4) \]

A feature vector (key point Descriptor) is formed by calculating a difference (m) and an angle (θ) between adjacent pixels. Under the condition of guaranteeing the rotation invariance of the image, assigning a direction to each feature point, the expression of the pixel gradient modulus and direction of
the feature point domain is as follows: L is the scale of the feature point, and (x, y) is marked the specific position of the feature point pixel is defined as the peak direction of the gradient direction histogram as the feature point direction [15].

\[
\begin{align*}
    m(x, y) &= \left[ (L(x + 1, y) - L(x - 1, y))^2 + (l(x, y + 1) - L(x, y - 1))^2 \right]^{\frac{1}{2}} \\
    \theta(x, y) &= \arctan \frac{L(x, y + 1) - L(x, y - 1)}{L(x + 1, y) - L(x - 1, y)}.
\end{align*}
\]

After the feature vector is formed, the portion that does not conform to the geometric transformation match is excluded by RANSAC (Random Sample Consensus). Then, the estimate homograph matrix is used for matching, and the image is stitched by image Warp transformation. The image warps transform to transform the point \( P_i(x_i, y_i, 1) \) into \( (x'_i, y'_i, 1) \) in homogeneous coordinate by H matrix (homography matrix). For the Warp transform, the H matrix is usually 8 degrees of freedom, solved by 4 pairs of feature points, and the matrix form of the image Warp transform is as follows.

\[
p' = H \ast p
\]

\[
\begin{bmatrix}
    x'_i \\
    y'_i \\
    1
\end{bmatrix} = \begin{bmatrix}
    h_{11} & h_{12} & h_{13} \\
    h_{21} & h_{22} & h_{23} \\
    h_{31} & h_{32} & 1
\end{bmatrix} \begin{bmatrix}
    x'_i \\
    y'_i \\
    1
\end{bmatrix}
\]

\[
x'_i = \frac{h_{12}x + h_{13}y + h_{13}}{h_{31}x + h_{32}y + 1}
\]

\[
y'_i = \frac{h_{21}x + h_{22}y + h_{23}}{h_{31}x + h_{32}y + 1}
\]

The image usually causes the illumination and hue of the picture to be inconsistent due to the situation at the time of acquisition and the movement away the camera lens. After the image is spliced, the effect of the parallax effect is caused by the convergence edge and the vignette effect. Therefore, it is necessary to adjust the color difference in the image, and eliminate the stitching to complete the image fusion. The methods of image fusion include Alpha averaging, Feather fusion, and Multi-Band fusion methods. The more common method of adjusting the chromatic aberration is the Reinhard method. By converting the RGB color space into the Laβ space through the calculation of the matrix, the correlation between the three primary colors is reduced, and the mean and standard deviation of the target image are adjusted by image statistical analysis. The formula for transforming space into Laβ space is as follows [16]:

The standard deviation adjustment formula:

\[
L = (n_1' \times n_1^{-1}) \times (1 - m_1) + m_1'
\]

\[
A = (n_2' \times n_2^{-1}) \times (\alpha - m_2) + m_2
\]

\[
B = (n_3' \times n_3^{-1}) \times (b - m_3) + m_3
\]

Formula: 1, a, b is source image values, L, A, B are converted values, m1, ma, mb, and m1', ma', mb' are the color channel mean of the shaded image and the source image, n1, na, nb and n1', na', nb' are standard deviations. The color spaced conversion formula:

\[
\begin{bmatrix}
    L \\
    M \\
    S
\end{bmatrix} = \begin{bmatrix}
    0.3811 & 0.5783 & 0.0402 \\
    0.1967 & 0.7244 & 0.0782 \\
    0.0241 & 0.1288 & 0.8444
\end{bmatrix} \begin{bmatrix}
    R \\
    G \\
    B
\end{bmatrix}
\]

\[
\begin{bmatrix}
    1 \\
    \alpha \\
    \beta
\end{bmatrix} = \begin{bmatrix}
    1 & 0 & 0 \\
    0 & 1 & 0 \\
    0 & 0 & 1
\end{bmatrix} \begin{bmatrix}
    \log L \\
    \log M \\
    \log N
\end{bmatrix}
\]

4.4. Construction of Panoramic City Public Participation Platform

In the choice of public participation platform, the platform with better dissemination should be selected. The traditional platform built with APP (Application) as the foundation of panoramic display has
relatively high learned cost and using cost, which is not conducive to large-scale promotion and dissemination. However, the display platform built on the website can be used through the browser of the terminal, which reduces the cost of use and learning. There are webgl, threejs, CSS and other methods to realize panoramic browsing on the web side. CSS (Cascading Style Sheets) is a computer language that is used to statically style through HTML or XML or more. 3D transformation of the cube can be realized through CSS and Panoramic browsing can be realized in the form of cube projection in the web page. The collected images can be realized as cube projection through CSS and the panoramic view of the cube can be established for planning and display. The realization of panoramic view only completes the basic browsing function of the platform. To realize point-to-point information displays and information collection in the panoramic view, it is necessary to convert the 2D coordinates on the screen of the 3D coordinates in the panoramic view to establish a connection. First step is to record the coordinates when viewers click on the screen and map the space position of the cube based on this location, then through some of the 3D library API (Application Programming Interface), such as using the Raycaster of THREEJS, and establish the linear mapping relationship between the 3D coordinates and 2D coordinates. Because THREEJS has the draw center as the origin and the mouse has the upper-left corner as the origin center, the position information on the mouse click event is converted to the position center. In creating Raycaster instance, according to click on the location of initialization after the start of the camera to create a straight line, perpendicular to the camera screen capture and straight line intersecting objects, record the target location in space. Then through the CSS will get returns to the 3D coordinates of 2D coordinates, according to the records of target location to generate the specified vector, to map to the position of the lens surface information to the upper left corner of the location of the origin, generated in the space of a specified tag is used to collect and display the relevant information.

In the management of platform data, MongoDB database can be used for data management. MongoDB is a database based on distributed file storage and a type of NoSQL database. It can provide a scalable and high-performance data management storage solution for web applications at the website. It has the characteristics of high performance, simple deployment, convenient use and efficient storage. MongoDB database can efficiently and conveniently manage the planned panoramic data and feedback information data onto the platform. Ajax (Asynchronous Javascript and XML), a development technique that is used to create interactive web pages, can be used to communicate management of data transfer from platform databases and platform application ends. Through the use of Ajax technology, the asynchronous update of web pages can be realized with a small amount of data exchange with the background and the server, and the application contented can be updated without reloading the web application data, which effectively improves the efficiency of data transmission when the platform is used. Redux technology can be adopted in the front-end architecture design of the platform. Redux is an application data flow framework, which can manage the application state of the platform of Redux.

5. The Functional Analysis of the Public Participation of Panorama Technology
3D virtual city can be realized by panorama technology without complex 3D virtual modeling through image stitching and transformation technology, which greatly reduces the construction cost of 3D city simulation. The ability to perform immersive browsing through the web can be achieved through CSS transformations without having to use a specific application platform, it makes this technique easier to use. Panorama technology can establish immersive interactive public participation platform with high usability at a low cost. Through panoramic change technology and web cloud technology, urban construction proposal collection, urban development boundary control, urban planning plan publicity, urban construction illegal supervision and other functions can be realized through the urban planning panoramic public participation platform and it can be used to ensure the scientific preparation and policy implementation of urban planning.

5.1. Collection of Suggestions for Urban Construction
For Suggestions for urban construction, the public can give feedback on the web through the panoramic public participation platform. The traditional method of suggestion collection in public participation is usually in the form of text, and simple language description usually cannot accurately reflect the specific situation in the actual scene, potentially raising the threshold of public participation. The panoramic
public participation platform is marked in the 3D urban space scene. The public does not need to use complex language to express but can simply put the accurate feedback on the Suggestions for urban construction in the specific actual scene, which reduces the cost of public participation and improves the participation efficiency.

5.2. The Boundary Control of Urban Development
In the process of urban construction, a reasonable urban development boundary should be established to restrain the blind expansion of urban land, and the urban development and construction should be carried out orderly under the boundary control. In the past urban planning, the display of urban development boundary only stays at the 2D level. Due to the general lack of professional knowledge of the public in urban planning, relevant departments are unable to deliver effective information on the public. Therefore, it is difficult to play the social supervision function of the public in the past control of urban development boundaries. Panorama technology vividly conveys the simulated information on urban development to the public. The public can play the function of social supervision without relevant knowledge.

5.3. The Disclosure of Urban Planning
The traditional public display of urban planning is mainly in the form of 2D plane, and the display of planning content is relatively stiff in the form of plane pictures. Usually, specific text interpretation is needed to make the public fully understand the content of planning in web side of the panoramic image forms to display, without a specific professional words vivid image of the planning in the message to the public, in front of the major projects of landing by panoramic platform for public participation in the public fully understand the content of the project and put forward concrete Suggestions on feedback, benefit to decrease the implementation of major projects.

5.4. Supervision of the Illegal Behaviors in Urban Construction
In urban construction, there are illegal behaviors such as destroying ecological landscape land and privately occupying public service lands, which have a direct negative impact on the implementation effect of urban planning and seriously affect the happiness of residents in urban areas. Strengthen the public's legal concept through panoramic display makes the public participate in the panorama platform. The public can use the mobile handheld terminal equipment to collect pictures of illegal phenomena and upload the panoramic view record of illegal phenomena to the platform in the way of panoramic transformation. The illegal behaviors can also be marked in the public participation platform by comparing the existing panorama display with the actual scene, the social supervision function of the public in can be given in urban construction.

Figure 1. The Application platform function analysis
6. Utility Analysis of Urban Planning Panorama Public Participation Platform

6.1. Low Cost of Public Participation in Urban Planning.
The lack of public participation is not caused by the avoidance of them. The rational analysis of "cost-benefit" also shows in the policy of public participation that individuals are only a small part of the public. If the time, money and energy required to obtain planning information is greater than the planning benefits obtained through participation, individuals will choose not to participate, that is, to obtain the same services as others at zero cost [17]. The participating platform decreases the learning cost of obtaining the detailed content of urban planning, it vividly expresses the information about the public through easier method. When the cost of participation is less than the gain from it, the public will be willing to join in the urban planning.

6.2. The Improvement of the Scientific and Democratic Nature in the Urban Planning Process
The preparation of urban planning is directly related to the life experience of the public. The layout and arrangement of various public service facilities and landscape lands in urban planning directly impact on the life convenience and comfort of urban residents. Citizens as the main group in urban areas and the aim at public facilities, the layout of urban functional land should focus on the needs of urban residents and seek the maximum comprehensive benefits to meet their needs. Collecting the suggestion of citizens can promote reasonably allocating the constructing land by the urban planning panorama public participation platform improves the scientific and democratic nature of urban planning.

6.3. Assist the Implementation of Urban Planning Decisions through Social Supervision
Through the urban planning panorama public participation platform, the public can intuitively understand the spatial distribution of various types of land in urban planning. Through the public participation platform, the public can supervise all kinds of land and buildings in the city, report the land that does not conform to the planning and the buildings that are built illegally, and give full play to the supervision role of the public in urban construction. By means of panorama technology, the stimulation of ecological control lines and urban development boundary in urban planning can be achieved, and some expansion behaviors that meet the standards and norms can be displayed on the panoramic public participation platform. The social supervision of the public can effectively prevent illegal boundary breaking and promote the healthy development of the city.

6.4. The Reduction of Conflicts in Planning Decision Implementing.
The urban planning panorama public participation platform provides an informal way for the public to participate in the decision-making of urban planning. When the major projects are implemented, as planning is a decision involving multiple interests, it often involves multiple interest appeals. Panorama public participation platform provides an informal way to participate in the interest appeal before the urban project is implemented, which is conducive to the early detection of conflicts caused by the lack of coordination, then take further action to prevent or reduce the conflicts so as to ensure the development of major projects in urban planning.

7. Conclusion
In the past urban planning, the public was excluded from the planning system, it makes public participation become a mere formality. The reasons for this situation are not only the negligence of related department but also the high cost of the public participation. Therefore, lack of enthusiasm and low cognition degree appears in urban planning. Due to the lack of channel of participation, the public cannot effectively express the interest appeal to urban planning which makes the conflicts in implementation. By analyzing the application of panorama technology in public participation in urban planning, this paper puts forward that using CSS and THREEJS and building panoramic urban planning public participation platform through WEB platform to provide an effective platform for public participation in urban planning are necessary. Due to the characteristics of high simulation, strong interaction, low use cost and low implementation cost of panorama technology, the learning cost of public participation in urban planning is effectively reduced, and the public awareness of urban planning
is enhanced. The interactive design of Panoramic participates in platform can improve the enthusiasm of public participation in urban planning. The panoramic public participation platform of urban planning provides an informal channel for the public to express their interests and reduces the possibility of conflicts in the implementation of projects. The panoramic technology in the application of public participation in urban planning research provides an effective solving idea of the difficulties in the public participation. This is very beneficial to improve the scientific and democratic nature of future urban planning, as well as the development of urban planning. At the same time, it highlights the people-oriented theme of the new era of urban construction.

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