

## CITIZEN PARTICIPATORY DESIGN METHOD USING VR AND A BLOG

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**Abstract.** This research concerned the establishment of a citizen participatory design method using VR and CGM. For this, problems in the citizen participatory design are addressed, and the continuous study method using VR and a blog is shown. Then, evaluation is conducted by considering an actual design project as a case study. Furthermore, VR functions needed through the case study are developed. Using this method, a small patio on which parasols were permanently and lawfully set up on a road lot was completed.

**Keywords.** Citizen participatory design; sustainable community design; design method; Virtual Reality; blog

### 1. Introduction

In order to reproduce a downtown area which has problems of people and businesses leaving the city centre, and aging of society, an approach was developed in which local residents and storekeepers participate in the renovation process positively themselves, sending a continuous message that the community area is energetic and sustainable. For this, there has been an increasing need for effective use of open street space. For example, social experiments in which cafes extend into the street space temporarily have been increasing rapidly since 2003.

When taking forward space study with a citizens' participatory design method, the validity of VR has already been shown to be an effective communication tool among stakeholders (Fukuda, 2003; Yeo, 2005; Matsushita Electric Works, 2006; Arima, 2007). The VR system is intuitive and easy to understand interactively. However, no reports have yet been made on using VR continuously after specifying a design process. Moreover, it is necessary to consider how media other than 3-dimensional media (records of meetings, existing examples, master plan, etc. in text or picture form) are unified with three dimensions.

This research is advanced in the following three ways. First, problems in the citizen participatory design method are addressed and a continuous study method using VR and a blog (web-log) is shown. Next, evaluation is conducted by applying the study method to consideration of an actual open space design as a case study project. Finally, further VR functions that are needed are developed as a result of evaluation.

## 2. Citizen participatory design and continuous design study using VR and a blog

### 2.1. CONSIDERATION OF CITIZEN PARTICIPATORY DESIGN PROCESS

Figure 1 shows the general stakeholders in a citizen participatory design process. The features and considerations are the following:

- Promotion of the continuous design study among a number of stakeholders: A method of continuously supporting the design process is needed. As data required for study, in addition to 3D models such as VR, texts and pictures such as records of meetings, an advanced example, and master plan data are included.
- Design creation and study by collaboration between residents and a design team: A designer must work with residents, seeing the situation from their viewpoint.
- Restrictions on the time and the place for a face-to-face type meeting: It is necessary for absentees and new participants at a meeting to rapidly understand the process of study.
- Growth of the community through a participatory process: Through this process, consciousness of the importance of community development is raised and the independent maintenance and operation is expected after spatial completion is completed.

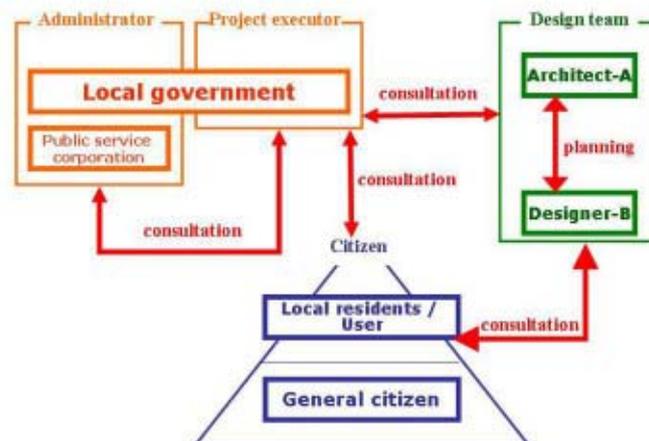


Figure 1. General stakeholders in citizen participatory design.

### 2.2. CONTINUOUS DESIGN STUDY USING VR AND A BLOG

#### 2.2.1. VR as a 3D design study tool

VR has already developed some functions with high accuracy, such as comparison of a present condition and plans, the patterns of parasols, sunlight shadow simulation. It is proposed that VR is used not to show the completed contents in the final stage as the presentation model, but also to show VR content of a design study at every meeting, like a physical study model. Although producing VR content in parallel with design study many problems, it was produced according to the content of each design study.



Figure 2. Examples of VR Contents (1: architectural design, 2: road design, 3: regional design).

### 2.2.2. A Blog as middleware of the design tool

Design studies are often advanced by holding face-to-face meetings. However, since not all members can attend every meeting, a system for sharing the design contents and arguments is needed. Therefore, the authors focus on CGM (Consumer Generated Media). This can improve communication because each stakeholder offers and shares information. The reasons authors adopt the blog system instead of the bulletin board system for CGM is as follows. The blog system can store multi media, such as text, drawings, CG still pictures, CG animations, and VR along a time-line. Formal and informal asynchronous communication can be performed. Update of information can be carried out easily. Category division and class division of information can be performed. Information is easily controllable person by person.

### 2.2.3. Considerations of using VR and a blog continuously

The anticipated problems in using VR and a blog continuously for a design study are described below.

- Regarding VR work, the design process does not yet address how VR contents should be produced efficiently.
- Regarding VR use, in the citizen participatory design, it has not yet been established what functions are required to allow effective inquiries using VR continuously,
- Regarding blog, a gradual method of information disclosure has not been established.
- Regarding blog work, it has not yet been established how far time and work effort can be reduced compared with a bulletin board system etc.
- Regarding blog use, it has not yet been established how understanding of a study process can be deepened by using a blog

## 3. Application and evaluation of the design study method in a case study project

### 3.1. CITIZEN PARTICIPATORY PATIO DESIGN PROJECT

The citizen participatory real design project is a small space named a “patio”, which is a road lot, and surrounded by buildings in downtown Takamatsu city, Japan. Originally, there were benches, signs, electric poles, garbage cans, etc. all over the open space in disorder. Moreover, multiple-purpose and constant use of the area was not possible. Therefore, the design concept removed the existing unnecessary elements. In this project, three shopping malls and a residents’ association established a council, and this council furthered the plan as the project executor. Moreover, the council members took a lead role in furthering the plan, took responsibility for maintenance, and planned events. Through the citizen participatory design process that operated from 2000, the patio was completed in Aug-2007 (Figure 3). Figure 4 shows the design process and stakeholders. There were four main steps in the design process of the patio. First, a designer and design team created a design proposal. Then, the council studied the proposal. The proposal was re-created based on the council’s study. Then, administrators, such as the government and the police, studied the proposal. Design publicity was carried out from the stage where the consensus-building of the proposal was carried out to the last stage. The process continued by trial and error.



Figure 3. Patio design project: (1) aerial photo, (2, 3) plan and photo of original condition, (4) design meeting between council members and professionals, (5) final plan, (6) completion.

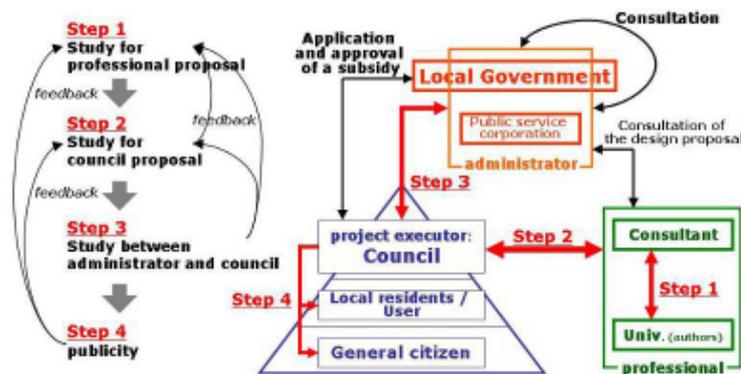


Figure 4. Design process and stakeholders of the patio design project.

### 3.2. APPLICATION RESULT OF VR

A total of 19 study meetings were held from May, 2005 to February, 2006. In these, VR was utilized a total of 12 times. The main contents of the study are shown in Figure 5.

Next, the work associated with VR contents is considered. As a result of producing content required for the design study preferentially for a short period of time, working efficiency improved. The buildings around the patio, 3-dimensional trees, and the night view, which required much work, were made later on. Moreover, when a design proposal needed to be studied the day after a design meeting, data optimization work was done after the meeting ended. In addition, it became clear that the amount of data needed a management method.

The use of VR is considered. In this regard, reaching an exact understanding of space according to the content of the space study, and lively discussion on the design are mentioned. The latter is described in more detail. From the initial stage of a design process, VR of rough accuracy was shown, like a study model. In the initial stages, although there were few opinions from council members, more opinions were expressed three months after VR introduction. Problems included raising the quality of representation of people, and a study function with greater dialogism.

3.3. APPLICATION RESULT OF BLOG

The blog articles were exhibited separately from the articles only for stake-holders and the articles for public presentation. Article inspection rights were established for the former. The number of stake-holders was 40 in total, such as council members and professionals. Moreover, the paper was devised so that it might be easy to access the information which a visitor wanted to acquire by classifying this information into two class categories (TABLE 1).

Next, the work associated with blog contents is considered. Work time and effort reduced sharply in regard to the input of reports, the layout design, user management, etc. as compared with the bulletin board system. Moreover, regarding rulemaking of information disclosure in the specialist team, this was fully established in advance and made available to the public. Therefore, the stake-holders involved in various positions were able to peruse it. Problems include the stability of system employment, and consideration of the information shortfall.

Next, blog use is considered. The blog was found to be very effective in allowing a virtual meeting between absentees and stake-holders involved in participation in the study process. Moreover, information exchange was facilitated by public presentation of the study process. For example, a student from another university applied to hold a social experiment in the patio. It can be said that the blog offered a meeting place for people. A problem was that there were only three uploaded comments from council members. There were two reasons for this lack of input. The member had met face-to-face frequently. The member's age group was highly unfamiliar with PC operation compared to younger people.



Figure 5. Application process of VR.

TABLE 1. Category of the patio project's blog.

Read me first (3 articles)	
Meeting outline (20)	Conference general meeting: Outline (6)
	Conference general meeting: Member (0)
	Patio steering committee: Outline (4)
	Patio steering committee: Member (1)
	Other meetings (9)
Design proposal (8)	Present condition (1)
	Space: Landscape Design (3)
	Space: Lighting Design (0)
	VR (Virtual Reality) (1)
	Activity/Management (3)
Master plan 2001 (6)	Present condition and vision
	Master Plan (4)
Reference data (19)	Photos (0)
	Similar case introduction concerning (16)
	About the history of the site (2)
About the history of Takamatsu city (0)	
Publicity (3)	

**4. Development of VR functions needed as a result of evaluation**

Two functions shown in italic type in TABLE 2 were developed. These were among the functions which the case study found should be extended by VR.

TABLE 2. VR extension functions which became clear in the case study.

Representation of contents	<i>Human</i>	<i>Motion and direction</i>
	Tree	Seasonal change and secular change
	Weather	Change of weather, such as fine weather and rainy weather
	Lighting	Solar dazzle
		Improvement in accuracy of lighting simulation
Interface	<i>Space design study support</i>	<i>Still pictures automatic creation function corresponding to the combination of all alternatives</i>
		Edit, saving, and loading of a proposal
	Design process support	Display of the design process in network type VR
	Extension of an experience function	Sound environment
		Smell of the environment
		Textures of an objective surface
		Smell of the space
	Space temperature	

4.1. REPRESENTATION OF A HUMAN’S MOTION OR DIRECTION

In this research, in order to provide high quality representation in a close-range view, photographic 2D data was used for representation of human beings. A 3Dsprite function was added to this data so that a 2D data source always has its surface facing into the camera. However, this method can be correctly expressed neither for the activity with a motion, nor directive activity. Development of the representation method of a motion and the representation method corresponding to all viewpoints was called for through the case study.

Pictures and a script are needed both for showing the person’s motions and for showing a 360-degree view from this person’s viewpoint. The picture generation process is described. First, a video of a person is recorded. A video showing the person’s motions and a video showing a 360-degree view from this person’s viewpoint are recorded at this time. Next, a loop section is extracted by movie editing software. Furthermore, each frame is changed into a still picture. Finally color adjustment and alpha channel generation of each still picture are performed by batch processing. Next, the processing flows of a script are shown; No.1 of Figure 6 for showing the person’s motions, and No.3 of Figure 6 for showing a 360-degree view from this person’s viewpoint. The sum total number of sheets of still pictures to be used is “a” (constant). The number of still pictures displayed with each frame at the time of VR reproduction is “t” (variable). The result shows the No.2 and No.4 of Figure 6.

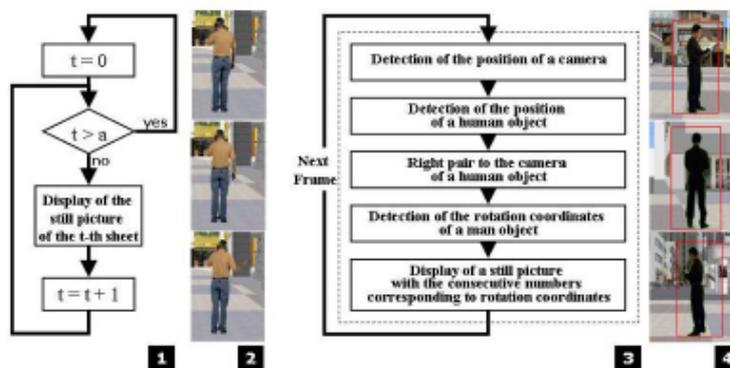


Figure 6. Process flow and result: showing the person’s motions (1, 2), showing a 360-degree view from this person’s viewpoint (3, 4).

#### 4.2. VR STILL PICTURES AUTOMATIC CREATION FUNCTION CORRESPONDING TO THE COMBINATION OF ALL ALTERNATIVES

In the case study, carrying out a screen capture of the VR image and creating a still picture was done by combining alternatives to the viewpoint place manually from the menu screen. However, when alternatives and the viewpoint place which should be studied in a study item are varied and there are a large number of combinations, the time and effort of creation itself is huge. For example, in a case study, a total of 420 sheets of still pictures was needed for the pavement plan of ten proposals, the parasol plan of seven proposals, the tree protector of two proposals, and three points of viewpoint places. Figure 7 shows system flow and VR still pictures generated automatically.



Figure 7. System flow (left), VR still pictures generated automatically (right).

### 5. Conclusion

A questionnaire result which has obtained a very high evaluation because respondents who were not professionals could understand plans intuitively was obtained. The system also helps to build trust among stakeholders. After design study and construction, this patio was completed in August 2007. In Japan, it is still very rare to set up parasols permanently and lawfully on a road lot. Thus, a presentation of the satisfactory solution for each position, continuous tenacious deliberations, and an intelligible communication tool were required in order to realize this. This new example is realizable with the continuous design study and tenacious deliberations using VR.

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