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ESTABLISHING PUBLIC CONSENSUS THROUGH DEVELOPING SPATIAL MULTIMEDIA SYSTEM TOWARDS SMART GOVERNANCE IN MANAGING CITYSCAPE PLANNING

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Abstract

The rapid development of information technology leads to the changes of the urban management system demanding the utilization of the smart city concept which aims to provide an environment for the community that is efficient, sustainable and secure, with the use of ICT (Information and Communications Technology). This paper utilized smart governance concept as one aspect of a smart city to improve and develop community participation in the visual quality control of urban spaces that meet the social aspects, economic efficiency and biological health of the community through visual quality evaluation activities on city space corridors. The development of spatial multimedia support system is one of the current development in urban planning that associated with public engagement. The objective of the study is to develop a scenario of the 3D spatial multimedia system as a Decision Planning Support System for structuring street corridor *landscape based on 3D Interactive Simulation System. Through the scenario of interactivity development, 3D visualization in the virtual environment is expected to be efficient as well as supporting the development of the effectiveness of decision-making system in the evaluation of visual comfort quality in the streetscape.*

Keywords

Good Governance, Decision Support System, Spatial Multimedia, Urban Visual, Streetscape

1. Introduction

Public participation is intended those who are affected by the result of the decision-making process in public consensus. The public consensus offers a way of making appropriate and efficient decisions by delivering comparable data and information that impacts on the right decision making. Community participation in the interests of urban planning is a form of community involvement in helping to determine the best choice or decision of the city planning forms offered. Every process of planning and urban design should involve the community in every decision-making process due to the impact of product planning and urban design on people living in the city either directly or indirectly. Thus, there are more and more individuals and groups of people who engage in these activities, which are expected that there will be more lessons learned to create a living environment that fits together. The practice of public participation may include various forms of activities such as public gatherings, workshops, and other types of direct public participation (Arbster et al., 2007). A level of community involvement varies greatly, from a low-impact to high-impact engagement. It depends on the purpose and benefits to be obtained from the public participation activities. So, the participatory techniques used also varies depending on the extent to which the goals, benefits, and impacts will be achieved or expected.

Public participation activities should have been done early at the beginning of the planning process as well as urban design aims to anticipate problems and mistakes in the process due to incompatibility with the reality on the ground. Furthermore, it also means to avoid the appearance of urban design products that are not in harmony with the community living there. The involvement of intensive and early public participation will probably give more success to an urban planning project (Wu et al., 2010). The primary objectives of public participation are to encourage the public to have active involvement in the decision-making process and to open up opportunities for communication between various parties involved (Burgess et al., 2003). This engagement can be a warning system for public awareness in the public engagement process to construct sustainable decision-making. The public participation can choose a degree level of participation due to the optimum of the result. According to Arnstein's (1969) as cited in O'Doherty & Richard (1996), there are eight typologies of participation that can be utilized as a framework for examining the status level of involvement.

There are two types of public participation techniques, which are traditional or formalized techniques (Rowe, 2000) and emerging or modern techniques. Along with the growth of epoch, a conventional technique of community participation gradually begins to be abandoned and replaced with the new methods. One contributing factor was the high costs required for the implementation of community participation through traditional methods and the difficulty of bringing the various parties due to the variation of the busy work of each. In modern techniques like in developed countries, online participation has opened up a wider range of opportunities for people to participate and get a better understanding of the whole project (Karki, 2009). To enable online participation, or e-Participation as it has become known as citizens only express their opinion and gather information through the internet. Cultural development of e-participants will be a trend in the future (Conniff et al., 2010). It is also affected by the development of many technological gadgets that support a wide range of interactive internet applications, and virtual reality applications (Howard and Gaborit, 2007). E-participation includes a variety of specificities in the development of computer information technology that combines online computer technology with human involvement. E-participant is a low-cost approach that related to ease of internet access and very useful for the openness of necessary policies and regulations to the community at large.

Public participation activities are related to public confidence in the stakeholder/ government. The primary basis of the procurement activities of public participation should be emphasized on the importance of the contribution to the community in providing input to the planning process of the built environment. Public trust will grow well if stakeholders always try to realize the agreements that have been formed. Consensus decision-making is one of the essential processes of public participation that seeks broad or full approval. Public consensus activities involve several groups that are committed to producing as many as possible agreements that can be achieved.

Along with the implementation of Law No. 22 of 1999 on the Regional Government and Law No.25 of 1999 on the Financial Balance between Central and the Local Government, or better known as regional autonomy, the role of the area becomes very important for efforts to increase the participation and well-being of society at large. The spirit which currently keeps rolling in the community, although in practice it has not been as expected a lot of parties. Perhaps that is a process that must be passed gradually and continue to be able to produce something better. By referring to Law No. 22 of 1999, it is defined that the local autonomy is an autonomous regional authority to regulate and manage the interests of his people by the people's aspirations by legislation. In other words, local autonomy provides the flexibility to set up their household affairs, including the area development planning in their respective regions.

All this time, the level of community participation in local development planning is still relatively low. This is due to several factors such as the lack of understanding of the importance of community participation in regional development, the minimum budget of establishment of the program dominated by political interests, limited access to local development planning information, no optimal planning apparatus in the area to solicit input and encourage the establishment of community participation, and the unintegrated schedule between planning forums and the schedule of parliament. On the other hand, society is no optimal in disseminating the importance of community participation in development and is not yet optimal involved in regional development. It was influenced by the limited human resources and the dependency of financial support from the government.

Furthermore, according to Nasar (1998), the successful designs must respond to the variations in experience over time, because we inhabit our communities over time. Every city should have a master plan of the urban image which represents the ‘dream’ of the urban communities. For that purpose, city planner should perform many kinds of research related to public preferences toward urban appearance. One important thing to do is measuring the evaluative image, the meaning, and community appearance for creating an objective basis for decision-making and also for urban policy reasons. It is necessary to perform an aesthetic assessment through the public participatory for making the suitable spaces to control and evaluate the city image. Community participation in decision-making encourages cooperation with the city planner to generate populist decisions which are more attached to the interests and the needs of society. Communities will feel appreciated and have the opportunity to participate actively in decision-making for the creation as well as ensuring a better, comfortable and more satisfying urban space. Thus, it will generate awareness among the public and enlightened the aesthetic judgment become a social instrument toward a better space for living.

City planner must have a comprehensive knowledge to shape the future meanings of the city so that people will be happy and enjoy the results. It is suitable if city planners are composed of various experts from different scientific backgrounds and included many community leaders. Experiencing in various cities is as diverse in its dealings with the public, one cares and one indifferent. However, it should not be discouraging to keep trying to build and create a city that guarantees satisfaction for many people. Slowly and gradually, the culture of participation must be initiated in any decision-making regarding the interests of the city.

In advanced, the development of spatial multimedia support system that related to public involvement in the urban planning is one of the prevailing developments (Brail and Klosterman, 2001). The utilization of spatial multimedia systems aims as a digital interaction medium between urban planning concepts and the rules and regulations of the city to the community. The system delivers 3D spatial modeling data that composed through a programming language and transformed into 3d virtual reality into the web interface design. Communities or users have the opportunity to explore while investigating 3-dimensional spatial concepts of urban planning (Dykes, 2000). Furthermore, the process of 3D virtual exploration must be supported by good and effective virtual 3D navigation technique, and the public or participants should be provided by three basic knowledge that supports the success of spatial exploration in the virtual world (Volbracht & Domik, 2000; Stefano and Chittaro, 2007; Stefan et al., 2009). Development of 3D spatial multimedia systems must also be coupled with an understanding of the strategies that must be met so that the system can be beneficial to the interests of proper planning. Dissemination of this system can utilize a variety of methods such as face to face, centralized resources, and distributed resources. It would be better if it is possible to use a combination of different approaches to optimize the benefits.

2. Objectives and methodology

This study aims to construct a conceptual framework of Decision Planning Support System for visual quality evaluation on the street corridor based on the public preferences of spatial and visual comfort.

2.1 Research Location

The location of the case study area is in Malang, Indonesia. The research concentrates on streetscape aspect of the street corridor in Malang.

2.2 Research Framework

This study involves three primary procedures. First, the investigation of public preferences. Second, the development of a spatial multimedia system. Third, the organizing of subsequential workshops.

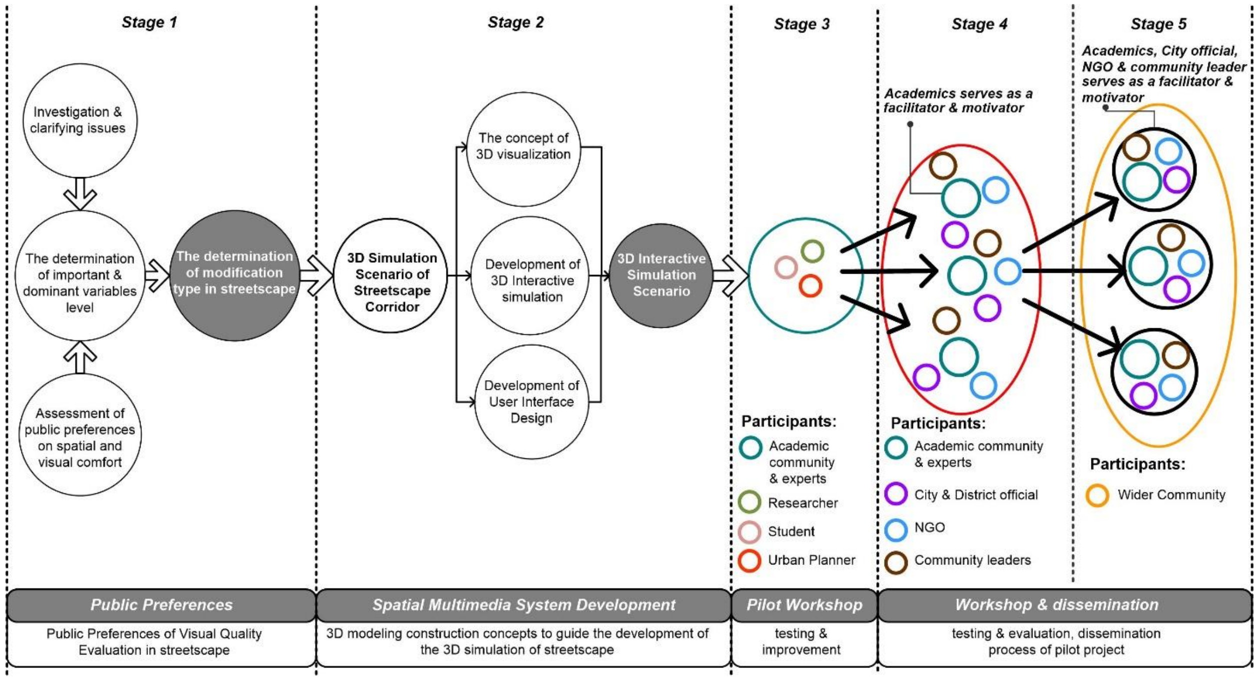

Figure 1: *The Research framework*

The first stage uses public preferences method through questionnaires to assess the quality of spatial and visual comfort in the street corridors. A spatial comfort and visual comfort applied as two important independent variables in assessing the comfort quality of the street corridor. A method of sampling employs non-probability sampling through purposive sampling technique. Variables used in this research are intended to concentrate the respondents' assessment against the visual and spatial comfort of the street corridor. The questionnaire points are composed of the 12 variables of the spatial comfort and the nine variables of visual comfort. Afterward, this study generates the determination of influential variables and the dominant variable level. Ultimately, the public preferences on spatial comfort and visual comfort produce the positive-scored rank elements which the scores are above 4 and negative-scored elements which the scores are less than 4. The highest score in the positive zone indicates the ideal condition is supporting spatial comfort and visual comfort, while the lowest represents the worst condition which needs improvement. In the meantime, the influential variables affecting spatial comfort and visual comfort based on the regression analysis result lead to the determination of the dominant variable level divided into a primary, secondary, and tertiary variable. In the end, it produces the determination of the vital modification parameter elements in spatial and visual comfort in the streetscape. The results of the first stage will be used for the development of 3D spatial modeling formation concept to guide the 3D virtual reality construction of a streetscape visualization.

The second stage is the development of a spatial multimedia system. This stage performs three crucial stages covering the concept of 3D visualization, the construction of 3D spatial interactive simulation system, and the development of User Interface Design Composition (Santosa, 2014). These primary stages produce three interactive hierarchy levels covering passive interactive, low-active interactive, and high-active interactive.

The third stage is the organizing of subsequential workshops that divided into three following workshops. In the first part is a pilot workshop that aims to conduct system testing and improvement. In the next section is a dissemination process that seeks to disseminate and evaluate the system more broadly to the broader community.

3. Result and Discussion

3.1 The Investigation of Public Preferences

There are two primary activities regarding the determination of crucial variables in the streetscape evaluation, i.e., the investigation and clarification of the issues, and the assessment of public preferences (Santosa et al., 2013, 2018). First, the identification of the problems along the Kayutangan streetscape. The activities of issue clarification are intended to define and establish the relevant and vital issues of the improvement of Kayutangan streetscape. Each participant in each group has diverse views and different levels of urgency to the priority issues. Therefore, to assist in the identification and confirmation of problems, the questionnaire tools, which are associated with the processing of the Analytic Hierarchy Process (AHP), are conducted.

The priority issues are identified along the streetscape, conducted through the Analytic Hierarchy Process (AHP), one of the decision support model established by Thomas L. Saaty. AHP is able to interpret the problem complex multi-criteria into a hierarchical arrangement in a multi-level structure so that the problems will present more systematic (Saaty, 1993). The filling of the questionnaire is conducted through the two stages. First, participants have to determine beforehand the criteria that are considered more important between the two choices. After making the selection criteria, the participant should determine an importance level of priority scales. The priority scales are divided into nine categories. The results of the priority issues in each group are compiled and compared in a table. The results compilation of the priority issues among the group is used to determine the overall ranking of priority issues. The basic formulation of the issue ranking will be determined to start from the most significant percentage of the problems. The final determination of priority issues uses a ranking system for the acquisition of the highest percentage. The top three of each priority are generated from each group, then they become benchmark ranking.

Table 1: *AHP scores based on the percentage of priority*

Zone	**No.**	**Issue**	**Weights (%)**		
			Group 1	Group 2	Group 3
Private zone	1	Building heights	18.8	6.1	**15.8** [3]
	2	Building setback	**25.3** [1]	**44.4** [1]	**43.2** [1]
	3	Building material	14	9	**23.6** [2]
	4	Building advertisement	**21.3** [2]	**13.3** [3]	5.6
	5	Building colors	**20.7** [3]	**27.2** [2]	11.8
Public Zone	1	Street width	9.2	9.3	11.6
	2	Street median	12	3	5.4
	3	Sidewalk Width	**26.2** [1]	**14.6** [3]	**20** [2]
	4	Sidewalk material	5.1	5.2	6.8
	5	Street lighting	5.2	7.8	12.3
	6	Billboard	**14.3** [3]	5.8	3.8
	7	Tree/ Greenery	8.7	**28** [2]	**16.5** [3]
	8	Parking	**19.4** [2]	**26.2** [1]	**23.6** [1]
Notes: [1] = first priority, [2] = second priority, [3] = third priority					

In the assessment activities of public preferences, it is conducted the questionnaire method. Spreading questionnaires covering of two categories of general independent variables, i.e., spatial comfort and visual comfort. Each of them is indicated by 12 sub-variables of spatial comfort and nine sub-variables of visual comfort. Sampling was determined by considering the aspects of knowledge, confidence, and experience of researchers in determining the members of the population sample be selected. Then it produces two critical things, namely the determination of an influential variable and the significant variable level. The determination of influential variable was generated from the judgment score that divided into two categories: positive score (when the variable scores are above 4) and negative score (when the variable scores are below

4). Through the assessment rank of the negative score element, it will identify the critical aspect of spatial comfort and visual comfort in street corridors (see. Table 2).

Table 2: *The example of assessment ranks of public preferences on spatial comfort and visual comfort in the streetscape in Malang*

Spatial Comfort				Visual Comfort			
Positive Scored Element		**Negative Scored Element**		**Positive Scored Element**		**Negative Scored Element**	
1. Vegetation function	5.09	1. Building setback	3.51	1. Human height and street furniture	4.27	1. Visibility proportion	3.76
2. Vegetation type	5.03	2. Sidewalk function	3.57	2. Signage visibility	4.13		
3. Vegetation position	4.79	3. Building border width	3.60	3. Visual appearance variety	4.12		
		4. Sidewalk dimension	3.62	4. Region dominant color	4.12		
		5. Sidewalk material	3.64	5. Building appearance	4.09		
		6. Sidewalk position	3.84	6. Street corridor transparency	4.07		
		7. Walking continuity	3.88	7. Building height proportion	4.07		
		8. Street furniture position	3.91	8. Human height and building height	4.03		
		9. Street furniture type	3.97				

On the other hand, the determination of the significant variable level was generated on the regression parametric partial test of the comfort variable for spatial and visual aspects. The analysis of significant variables affecting both aspects conducted through classifying the streetscape elements into three categories, which are primary, secondary, and tertiary. The primer element is the one whose p-value is less than 0.05, and the Standardized Coefficients are the furthest from zero, while the secondary elements are those whose p-value is less than 0.05, but the Standardized Coefficients are closer to zero. In the meantime, the tertiary elements are those with p-value more than 0.05, which the rank of Standardized Coefficients based on their distance from zero: the closest is the one which is the least dominant variable partially affected the spatial and visual comfort (see Table 3.)

Table 3: *An example of significant variables affecting the spatial and visual comfort of the streetscape in Malang*

Variable	The Dominant Variable Level											
		Primary				Secondary				Tertiary		
		Element	Significancy P-value	Standardized Coefficients		Element	Significancy P-value	Standardized Coefficients		Element	Significancy P-value	Standardized Coefficients
Spatial Comfort	1	Sidewalk position	0.03	0.4					1	Vegetation function	0.09	0.3
									2	Vegetation type	0.13	-0.28
									3	Building border width	0.14	0.24
									4	Sidewalk material	0.24	0.18
									5	Street furniture position	0.4	-0.11
									6	Street furniture type	0.5	-0.1
									7	Sidewalk dimension	0.55	0.1
									8	Walking continuity	0.48	0.09
									9	Sidewalk function	0.72	-0.06
									10	Vegetation position	0.77	-0.05
									11	Building setback	0.91	-0.02
Visual Comfort					1	Street corridor transparency	0.048	-0.25	1	Human height and street furniture proportion	0.12	0.19
									2	Visibility proportion	0.2	0.18
									3	Building appearance uniqueness	0.34	0.13
									4	Region dominant color	0.38	0.12
									5	Visual appearance variety	0.51	-0.1
									6	Building height proportion	0.63	-0.07
									7	Human height and building height proportion	0.89	-0.02
									8	Signage visibility	0.92	-0.01

3.2 The Development of Spatial Multimedia System

3.2.1 The Scenario of 3D Visualization

The formulation of 3D visualization concept is an early stage to determine the direction and objectives to be achieved in the manufacture of 3D simulation. Four basic scenarios must be observed and adequately conceptualized, namely 3D visualization concept, the level of geometry detail, the idea of interactive, and the concept of navigation. The idea of 3D visualization and imagery to estimate the ultimate form of 3D virtual models of a streetscape, including the number of 3D building objects that must be created and streetscape elements that must be taken into account. Setting the level of detailed geometry on the construction of each 3D object should consider the number of polygons used. On other hands, the strategy of the navigation system in 3D virtual reality considers the approximate path of user movement while exploring virtual 3D space. The navigation concept also aims to allow a user to explore the simulation space and prevent the user from having lost in space. The duration of the visualization stage of making a 3D model in virtual environments depends on the complexity and diversity of 3D models that must be arranged. In principle, six elements must be arranged in a 3D visualization, which is composed of topographical maps, geographical data, and site & building plan, building façade, landscape elements, and other supporting data. The wider the area of the 3D visualization object, there will require more data, spend the times and effort and cause the work to be more complicated.

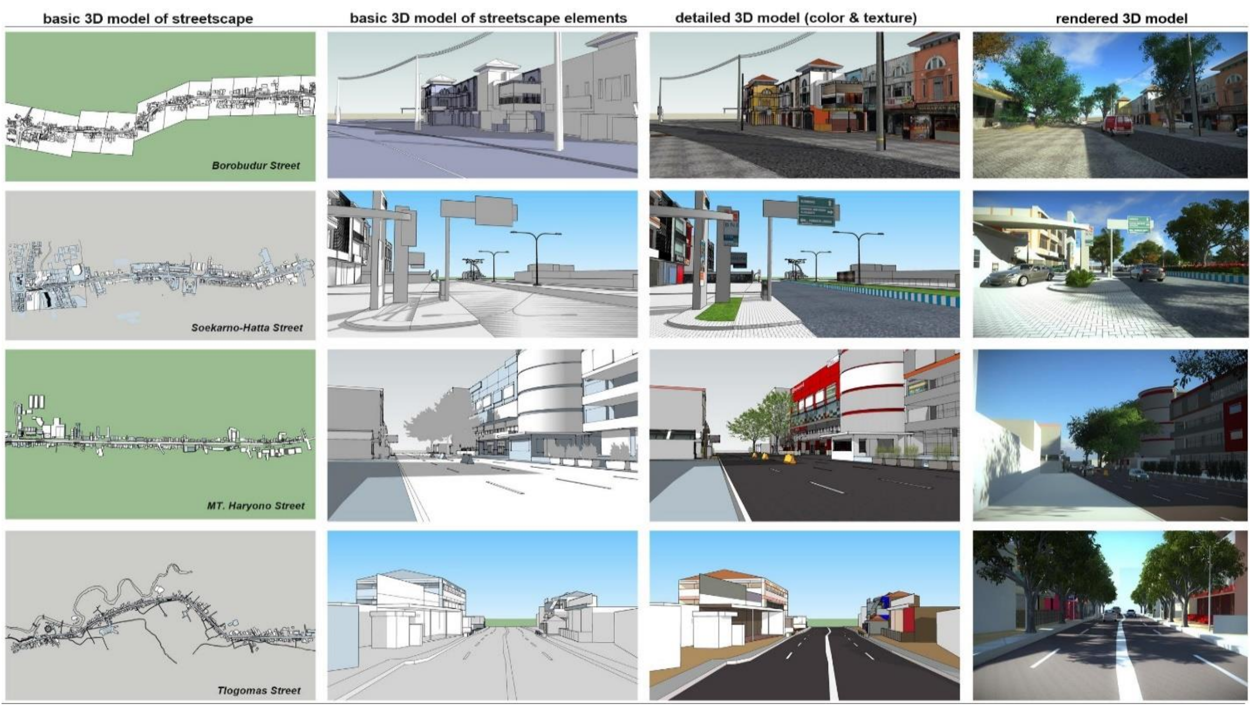

Figure 2: *The stage of creating 3D modeling from the 3D basic model to 3D rendered model*

Visualization scenario of 3D modeling is closely related to the development of the level of geometry detail as well as the navigational aid system. Development of a detailed 3D geometry modeling is aimed to foster a sense of place for the user through the walkthrough navigation to apprehend the urban space. However, this becomes a dilemma; when creating 3D models becomes more detail and is almost similar to the original model, it will cause the 3D file becomes too large and very heavy when later is processed in 3D programming software.

A 3D modeling process is the most critical stage in the 3D virtual construction. 3D model construction will determine how the detailed geometry level will be built, and the extent of virtual reality environments will be constructed. The phase of 3D modeling consists of four elements, i.e., modeling topographic modeling, building modeling, landscape modeling, and street furniture modeling. Each 3D object has a difficulty level and different challenges. Therefore, it needs to be considered earlier in the strategy of construction each 3D objects.

3.2.2 The Advancement of 3D Spatial Interactive Simulation

The concept of 3D simulation promotes an active interaction. Active interaction means that the user has control to direct the movement simulation and interaction of 3D objects in the 3D virtual reality (Kjeldskov, 2013). In Laing et al. (2007), the term of Active navigation is used to give the user freedom to interact, while this interaction is based on the ability of the user to manage the movement path of the virtual environment simulation in accordance with the free will of the user. Users have the opportunity to explore virtual world 3D space independently so that it needs to be given the ability to control navigation freely and more fruitful in understanding the virtual world. Furthermore, in the Virtual Environment, a user can interact with movement, make changes to the 3D object, and also access information as well as description associated with the identity of a 3D object.

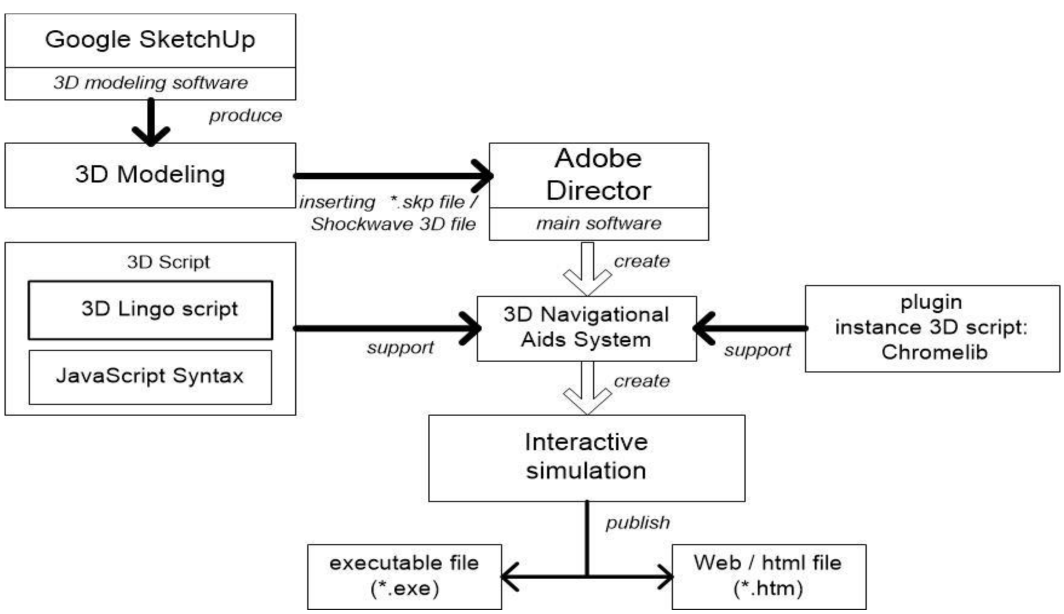

Figure 3: *The development process of 3D spatial interactive simulation*

The development concept of 3D interactive simulation offers the freedom of interaction through categories: select, use, do, and create. Freedom interactions "select" is given to the user to freely select the 3D simulation on the desired type of streetscape. Freedom of interaction "use" is given to the user to freely explore the streetscape 3D simulation using control buttons on the keyboard, and also the freedom of 3D object adjustments through the control panel provided. Freedom interactions "do" is given to the user to assess each streetscape 3D simulation, by providing a numeric value in the field provided. While freedom of interaction "create" is given to the user to freely explore the 3D simulation as well as perform an experiment on 3D objects to make an adjustment or modification of the 3D object.

Figure 4: *Three User Interface Design (UID) of 3D interactive simulation level: (1) passive interactive-basic level, (2) active less interactive-intermediate level, (3) active high interactive-advanced level*

In the user interface design, the interactive concept of 3D simulation implemented on three types of activities consisting of active navigation, interaction with objects, and evaluation. Active navigation is the same navigation type with navigation type in the intermediate level. Types of navigation controls cover forward motion, backward motion, move left and move right. The navigation controls consist of the direction of the arrow keys of the keyboard, with no extra buttons. Activity interaction with an object is an activity to interact with the 3D object. Interaction object is an object editing activity which consists of add or shows an object, deletes or hides objects, adjusts the position of an object, and adjusts color or texture of the object. Interaction objects can be performed through the button panels which are provided in accordance with the naming of a 3D object's identity. While the activities of the evaluation are the assessments against the visual streetscape respectively on each of the available 3D simulations.

Evaluation activities are divided into three parts consist of capturing a 3D scene, saving 3D object preferred, and scoring of choices. Capturing 3D scene is used for recording a picture of the scene, which will be used as advanced evaluation in the further discussion. Saving 3D models are used to store the results of the changes in the 3D simulation streetscape files. The 3D simulation file object is stored in a 3D shockwave file. Therefore, a 3D shockwave player is necessary to open the Shockwave 3D file. And last, an assessment is conducted by scoring the number of each type of streetscape. Scoring is also performed using a Likert scale with an interval scale of 1 to 7.

3.3 Workshop and Dissemination Process

The pilot workshop was carried out by involving academics, practitioners, government, and master students of Architecture. Once the participants understand the critical issues, each participant tried to operate the system by a group and individually. While running the system, they also held discussions on any decision to be taken. Every decision tested by the operating system to observe the changes in the quality of the streetscape. The results of the declaration of issues on each group revealed that the AHP results are by the agreement of each group. Also, the participants also recommend to include the building advertisement and the building color in the priority issues, due to the importance of these two criteria as the cause of the declining quality of streetscap**e**.

At the beginning of the process of operating the Decision Support System for improving the streetscape, participants require considerable adaptation to the understanding of the system. The participants had never seen and had no experience with the system, and this system has yet been implemented in Malang, Indonesia. Participants require a chance to conduct trials, before deciding on the system. At the end of the operating the system, the presentation and discussion are carried out to provide a review of the performance of the system as well as other variables outside the method.



Figure 5: *The pilot workshop activities with the academic community and the expert*

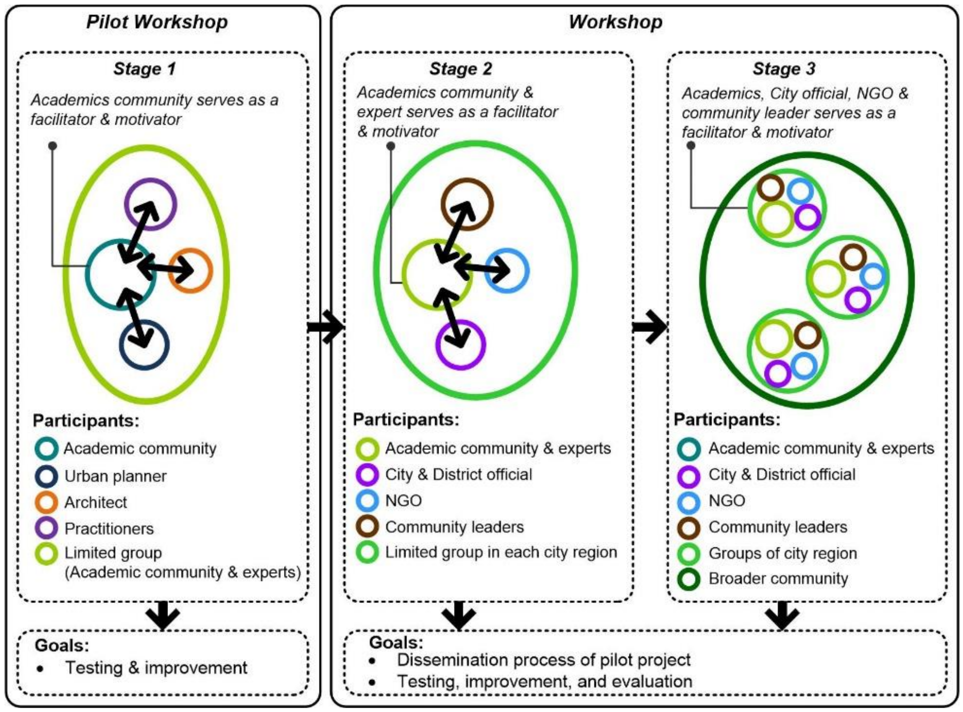

Figure 6: *The comprehensive workflow agenda of the dissemination process of system improvement*

Dissemination strategy for the development of multimedia spatial interactive application systems should be carried out in a phased workshop activity involving relevant parties, starting from limited community groups to a broader audience as shown in figure 4. The workshop divided into three stages, the first stage for the pilot workshop and the others for advanced workshop. In the early stages, the workshop aimed to test and improve the system and invite the academic experts in the field of Architecture and Urban Planning, practitioners, undergraduate students, and master students. The second workshop performed continued dissemination process of the system and invited more participants from the city government, NGO, and the community leaders. The advanced stage of workshop performed dissemination system for the broader participants from the broader community.

4. Conclusion

Development of spatial multimedia systems in support of the planning system should have a well-planned strategy. The problem context should thoroughly be accommodated by the objectives, methods, tools, and the design of the system. Initial activity should consider adequate investigation that is consisting of two significant actions, i.e., physical characteristic investigation, public preferences assessment. Both investigations generate the influential variable that is considered necessary by the public. This result is an essential consideration for the formation of 3D object modification parameters in the interactive simulation system.

Related to the construction of a 3D spatial interactive simulation system, the aspects of users or the public will be involved as participants in the system. The design of the system interface should be designed such that it has the ability user-friendly. The system is intended to be used by users with different levels of knowledge. Annotation system is the most critical aspect of a spatial multimedia system; therefore, the system must be designed annotation that able to accommodate different types of information forms that explain optimally and adequately to the users. This system should also obtain an evaluation and assessment of user feedback as input for better system improvements through the workshop in stages and continuously.

The limitation in the development of the 3D spatial multimedia system is related to the readiness of technological devices and human resources in the development of technology in the government, particularly in Indonesia. Based on similar research that has begun to flourish, there are several things to develop in future research. First, the challenge is to improve the quality of real 3D, which is balanced with the burden of a lightweight application for users. Second, the system development in online applications is expected capable of integrating spatial 3D data with geographic system data, along with all related analyzes. Third, the advancement of the spatial multimedia system should be accompanied by intensive dissemination activities by involving many relevant stakeholders.

References

Arbter, K., Handler, M., Purker, E., Tappeiner, G., and Trattnigg, R. (2007). The Public Participation Manual: Shaping the Future Together. Vienna, Austrian Ministry of Environment and ÖGUT 9.

Brail, R.K., Klosterman, R.E. (2001). Planning Support Systems: Integrating geographic information systems, models, and visualization tools, California: ESRI Press Redlands.

Burgess, H., and Spangler, B. (2003, September). "Consensus Building." Beyond Intractability. Eds. Guy Burgess and Heidi Burgess. Conflict Information Consortium, University of

Colorado, Boulder. Retrieved from http://www.beyondintractability.org/bi-essay/consensus-building

Conniff, A., Craig, T., Laing, R., and Galán-Díaz, C. (2010). A comparison of active navigation and passive observation of desktop models of future built environments, Design Studies, 31(5), 419-438. https://doi.org/10.1016/j.destud.2010.04.003

Dykes, J. (2000). An approach to virtual environments for visualization using linked geo-referenced panoramic imagery, Computers, Environment and Urban Systems, 24(2), 127-152. https://doi.org/10.1016/S0198-9715(99)00053-8

Howard, T., Gaborit, N. (2007). Using Virtual Environment Technology to Improve Public Participation in Urban Planning Process. Journal Urban Planning. Dev., 133(4), 233–241. doi: 10.1061/(ASCE)0733-9488

Karki, A. (2009). Using Technology to Enhance Public Participation in Urban Planning. In Partial Fulfillment of the Master of Urban and Regional Planning Degree Requirements. The Hubert H. Humphrey Institute of Public Affairs. The University of Minnesota.

Kjeldskov, J. (2013, February 18). Combining interaction techniques and display types for virtual reality. Retrieved from http://people.cs.aau.dk/~jesper/pdf/conferences/Kjeldskov-C2.pdf

Laing R., Conniff, A., Craig, T., Galán-Díaz, C., and Scott, S. (2007). Design and use of a virtual heritage model to enable a comparison of active navigation of buildings and spaces with passive observation, Automation in Construction, 6 (16), Issue 6, 830-841.

Nasar J.L. (1998). The evaluative image of the city. London & New Delhi: Sage publications, Thousand Oaks

O`Doherty, Richard K., (1996). Planning, People, and Preferences: A Role for Contingent Valuation. England: Avebury

Rowe, G., L.J. Frewer, (2000). Public Participation Methods: A Framework for Evaluation. Science Technology Human Values, 25(1), 3-29. https://doi.org/10.1177/016224390002500101

Santosa H, S Ikaruga, T Kobayashi. (2013). Visual Evaluation of Urban Commercial Streetscape Through Building Owners Judgment: Case Study in Malang city, Indonesia Journal of Architecture and Planning 78 691 pp 1995-2005

Santosa H, S Ikaruga, T Kobayashi. (2014). Development of Landscape Support System Using Interactive 3D Visualization Journal of Architecture and Planning 79 706 pp 1995-2005

Santosa H, Ernawati J, Wulandari L D. (2018). Visual Quality Evaluation of Urban Commercial Streetscape for The Development of Landscape Visual Planning System in Provincial Street Corridors in Malang, Indonesia Friendly City 4 'From Research to Implementation For Better Sustainability' IOP Conf. Series: Earth and Environmental Science 126 (2018) 012202

Stefan Münzer, Seufert, T., Brünken, R. (2009). Learning from multimedia presentations: Facilitation function of animations and spatial abilities, Learning, and Individual Differences, 19(4), 481-485. https://doi.org/10.1016/j.lindif.2009.05.001

Stefano Burigat, Luca Chittaro. (2007). Navigation in 3D virtual environments: Effects of user experience and location-pointing navigation aids, International Journal of Human-Computer Studies, 65(11), 945-958. https://doi.org/10.1016/j.ijhcs.2007.07.003

Volbracht S., Domik G. (2000). Developing Effective Navigation Techniques in Virtual 3D Environments. In: Mulder J., van Liere R. (eds) Virtual Environments 2000. Eurographics. Springer, Vienna, 55-64. https://doi.org/10.1007/978-3-7091-6785-4_7

Wu H., He Z., Gong J. (2010). A Virtual Globe-based 3D Visualization and Interactive Framework for Public Participation in Urban Planning Processes, Computers, Environment and Urban Systems 34 (2010) 291–298. https://doi.org/10.1016/j.compenvurbsys.2009.12.001