Restoration of Ecological Environment Using Mixed Reality Technology

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Abstract- *The need for urban ecological environment is becoming more important.* *Initially a grey box model based on Xtensible Markup Language and Group Innovation Space software and X3D virtual reality development platform is build. Then X3D virtual reality development platform and Kinect equipment is used to achieve the user and the system somatosensory interaction. Then the improvement of HMM gesture recognition algorithm based on both hands is proposed. Finally, AR Toolkit is used to display the information of the virtual environment and initial integration of virtual reality and augmented reality technologies[1].*

Keywords- 3D Interaction; Ecological Restoration; Augmented Reality Interaction; Hand Gesture Recognition.

I. INTRODUCTION

Ecosystems consist of animals, plants and the environmental conditions of an area. Ecosystems maintain a very delicate balance. Various human activities such as pollution, climate change, resource exploitation, land clearing etc threaten to disrupt this balance and destroy the ecosystems [2]. Restoration of these damaged and destroyed ecosystems is very important. Main aim is to develop smart city which provides core Infrastructure, public safety, good governance, network security and sustainable open green space. MR technology isused to provide better service for urban ecological restoration. MR technology provides a realistic, interactive, multi-dimensional visual environment. Such technology can better display environmental monitoring, ecological restoration process. A three-dimensional, dynamic, real-time,

Visual virtual simulation environment is established [1].Augmented reality is an important branch of virtual reality technology. In order to realize the enhanced expression and interactive function of 3D interactive ecological restoration system, the augmented reality development kit AR Toolkit is used[2].The somatosensory interaction technique is one form of the perceptual user interface which is used in virtual reality. Somatosensory interaction is a kind of technology, referring that the user interacts with the machine through their body movements directly. This technology aims to build a more natural interaction environment, which simulates the user's scene to create a 3D virtual model. At the same time, it combines with the gesture recognition technology to identify the user's actions. The set of processes makes users seem to feel the real sense in the process of the use of somatosensory interaction.

II. LITERATURE SURVEY

Florin Girbacia, Silviu Butnariu, Alex Petre Orman and Cristian Cezar Postelnicu.

In this paper, an approach for the virtual restoration of the religious heritage objects is proposed. The presented method is based on Augmented Reality technologies, which enable virtual restoration of the original heritage object by co-locating the reconstructed 3D virtual model with the real one. This method gives the opportunity to better perceive the damaged object. The proposed method consists in the following actions: obtain documentation about the damaged heritage object, processing of the documentation, 3D reconstruction of the monument, finishing and completing details, registration of the co-located 3D virtual model. The output of the proposed method is a reconstructed 3D model of heritage object, which can be visualized co-located with the real one by using common equipment such as Smartphone or Tablet PC. The application of the proposed methodology, which is used as a case study, was conducted in Brasov,at the Black Church. The proposed methodology may open new possibilities for the restoration of other religious heritage objects.

Kyriaki Oudatzi.

This paper presents a new approach in restoration study, a digital application of 3d model projection with intuitive and interactive use, through hyper-realism technology, applied in a virtual reality-based restoration project and in the reconstruction of the original form and function of a religious monument, of the Alaca Imaret Câmi, a mosque in Thessaloniki (North Greece). The presentation deals with new and very recently developed digital technologies, utilized in representing a virtual reality view of our cultural heritage. The 3d model projection, realized through brand-new audio-visual systems, will soon permit the expansion of 3d virtual restoration and hyper realistic touch of a virtual space, in many applications, while the most interesting of them, is the cultural heritage. The presentation – through web cam projection - of this paper, intents to show the successful results of using high technologies in the field of restoration but also in the creation as a virtual reality of the original form and function of a historic monument. The application of the new method proposed, applied in Alaca Imaret Câmi, which is used as a case study monument, becomes more interesting, when the monument itself, acts as a unique witness of a historic past or represents another culture, completely different from the context of the modern city. While using the 3d application, the visitor can learn all about the history of a monument, through an interactive experience. This gives him the opportunity to learn in a more detailed way the history of the monument, as no other way or no other method could succeed it. As a case study for these 3d model digital applications, is chosen the mosque of Alaca Imaret Câmi - an almost abandoned monument, situated in the historic centre of the city of Thessaloniki - not only because of its unique architecture and religious use but mostly because of its great importance in the history of the city.

III. ANEWINTEGRATIONMODELOFGISANDVRBASEDONXMLTECHNOLOGY

In this paper, a new integrated model of GIS and VR-grey box integration model is used to carryout data interoperability between VR technology and GIS.

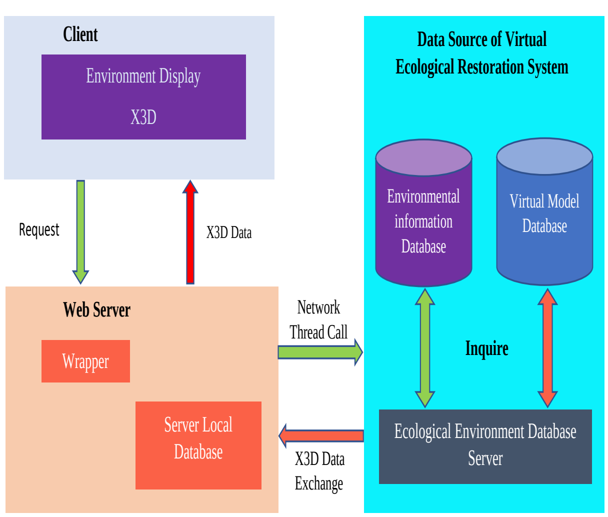

Figure 1: GIS and VR interoperability model based on XML Technology

XML isused as data transmission and storage format. X3 Disused to encode 3D geographical and environmental data. The GIS is used to display personalization and diversity of the requested data on the client side. The Web server is used to identify and convert 3D data in response to client requests and to query geometry and attributed at a from the under lying database[1]. Wrapper is an important part of server side, it is responsible for the transformation of terrain and environment data and X3D format.

WrapperusesJavaServletdevelopment,throughtheJDBCODBCbridgeorOracleJDBCaccesstoSQL,Oracleandotherdatabases[1]. Initially, client sends a request to web server which in turn calls the ecological restoration system. This system returns requested data in X3D format to the web server to display it on the client side[3].

IV. APPLICATIONOFAUGMENTEDREALITYARTECHNOLOGYINHUMAN-COMPUTERINTERACTIONMODULE

Firstly, the mark detectionis carried out, and the model is converted in to two value black and white planes according to the set threshold; Then, the connected region of the two valued image is analyzed, and all the quadrilateral regions are selected a scan did ate matching regions. Match eseach candidate area with the template in the system template library, and finds a logo if the match is successful[1]. The location and pose of the model identification are calculated by the deformation of the identification region, and then the coordinate transformation isused to identify the virtual mode. Finally, the 3D registration between the virtual and the real is realized according to the transformed matrix, and the location, coordinate and orientation of the enhanced model are determined[1].

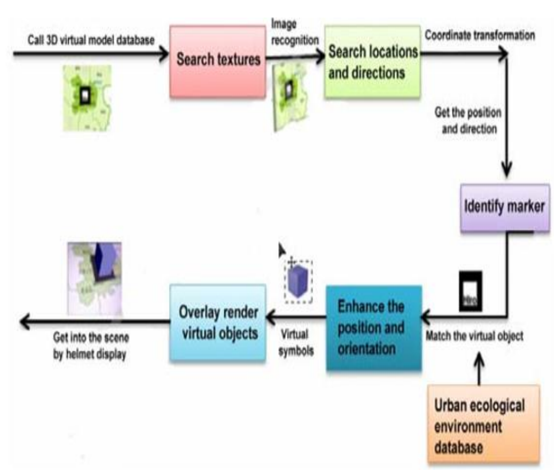

Figure 2: Virtual environment enhancement flow chart

V. NEW HAND HMM GESTURE RECOGNITION ALGORITHM

As single hand gesture recognition method is single, and the accurate recognition rate is not high, we improve the HMM gesture recognition algorithm.

Dynamic hand gesture recognition extending from single hand dynamic gesture recognition to both hands[4].

The basic idea is that the left-hand gesture is mainly used to control navigation, that is, to adjust the view angle of the scene, and the right hand gesture is mainly used for manipulating virtual objects. We use data glove 5DT14ULTR A sensor distribution, a sensor of each glove, respectively to the output bit unsigned value indicates the basal and middle finger joint flexion extension between adjacent fingers or extension of a work cycle[4].

We use ten tuple (K1,K2...K10) represents the bending state of ten finger joints (sensor 0,1,3,4,6,7,9,10,12,13), in which the element values can be 1,0,1, which describes the gesture. 1 indicates that the finger joint of Jis stretched, and 0 indicates that the finger joint of the J sensor is be nt, and -1 indicates that the finger joint status of J sensor is meaning less [4].

The gesture data is input on the basis of the initial HMM of hand gestures in two groups of gesture data samples with the left hand K1 and the right-hand K2 Specific process steps are shown below:

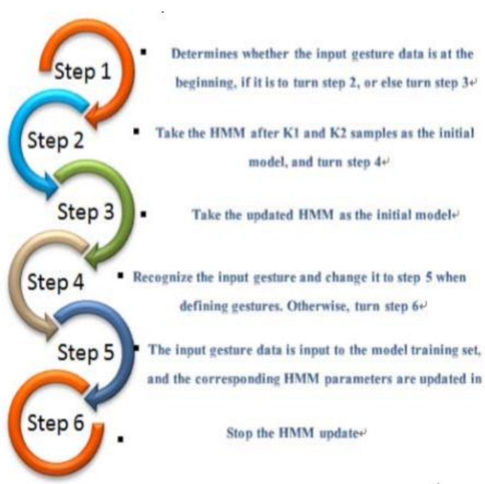

Figure 3: A new hand gesturere cognition HMM Iterative training flow chart

$$\overline{a_{ij}^{(h)}} = \frac{K1+l_h-1}{K1+l_h} * \overline{a_{ij}^{(h-1)}} + \frac{1}{K1+l_h} a_{ij} \quad (1)$$

$$\overline{b_{ij}^{(h)}} = \frac{K2+l_h-1}{K2+l_h} * \overline{b_{ij}^{(h-1)}} + \frac{1}{K2+l_h} a_{ij} \quad (2)$$

In the above formula K1 is the left-handed gesture data sample. K2 is the right-hand gesture data sample. His the group for hand gesturere cognition model learning and updating.

l_h represents the number of learning updates based on the initial model. Aij represents the corresponding state transition probability matrix is learned when studying hand gesture data of grouph alone.

The formula(1) indicates that the left hand K1 gesture data is added to the group, and the HMM model state transition probability matrix is updated after updating the data.

The formula(2) represents the right K2 gesture data added to grouph, and the data up date corresponds to the HMM model state transition probability matrix. The left-hand gesture HMM is basically convergent after a certain number of learning updates.

VI. V. CONCLUSION

So far, the application of MR technology in urban environmental field is still very limited. MR technology is often used as a specific means of performance, and has not yet become a good tool for ecological environment restoration design[1]. The city is constantly changing, and the ecological environment of the city can not be fixed. The design process of the ecological restoration scheme is a processs of constantly adjusting he plan. Therefore, the research on the theory and technology of the new and efficient urban ecological restoration system based on MR technology has become a hot research topic all over the world[1].

MR technology will offer cost-effective processing power facilities and vision/image recognition competencies. Big data and cloud computing will play a significant role in advanced MR technologies. Mixed Reality will change the communication between human and computer and take it to a new level. Restoration projects are also used as a way to better understand what makes an ecological community resistant to invasion. As restoration projects have a broad range of implementation strategies and methods used to control invasive species, they can be used by ecologists to test theories about invasion. Restoration projects have been used to understand how the diversity of the species introduced in the restoration affects invasion.

REFERENCES

[1] Xu Wu, Ren Yi Long, Guo Wei, He Jin. Research on Three-Dimensional Interactive Restoration of Ecological

Environment Based on New "Grey Box Model" MR Technology. 2017 2nd IEEE International Conference on Computational Intelligence and Applications.
[2] Zhu Hua, Zeng Guangming. Application of 3Sand VR technology in environmental planning[D]. Journal of HunanUniversity,2014,04.11-14.
[3] Wang Qiong. Application of multimedia DLL sin digitalcity planning and design[J]. Chinese branch of Zhongn an design and Research Institute of municipal engineering, Xinjiang, 2015, 10.22, 14-21.
[4] WangYongjian. Development of intelligent simulation system for operational evaluation of marine antipollution equipment[J] .XML School of marine engineering, Jimei University, 2012, 21(5): 183-184
[5] LiFuqiang. Application of holographic images in environmental protection system[J]. Zhangjiakou environmental information center, 2011, pp.68-73.
[6] Wang Tiany In virtual reality application in air pollution diffusion simulation[M]. Nankaicampusin formation management section, 2012(10):pp.45-47.
[7] LiuWei. Development of general platform for substation simulation training system[M]. Zhengzhou University of technology, 1999, pp.38-41.
[8] Zhao Zhengbing, GaoQiang. Blind source separation in electrical equipmenton-line monitoring of temperature applications C, High voltage technology. 2007,33(8): pp.18-21.
[9] Zhang Qiuju, Tong Ming. The realization of the virtual environment dint feel interaction. Machine Design and Manufacturing Engineering. 2001, pp.33-35.