An Interactive Virtual Training System Based on Augmented Reality

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Keywords: Virtual Training; Interactive; Augmented Reality; Agriculture

Abstract. Augmented Reality (AR) is a novel interaction way in many fields and applications, and it provides more direct and sensory operation mode for human-machine interaction. Virtual training is becoming an effective approach for knowledge transfers in various fields including agriculture. Augmented Reality can promote virtual training in agriculture. In this paper, we presented an interactive virtual training method and developed a system based on Augmented Reality for agriculture. By use of D'fusion framework-a developing platform based on Augmented Reality, we implemented the presented algorithm and combined relevant agricultural training knowledge. The system gave interactive operations like games with an example of strawberry. The virtual models of strawberry were constructed by real three-dimensional data to ensure the realistic training results. The system provided a convenient interactive training-learning software tool. Finally, the future works in deeply applications are discussed.

Introduction

Along with the development of modern agricultural technology, agricultural training can help employees to master the use of the modern agricultural production tools, modern farm management, and improve the cognitive ability of agricultural products, helping non-agricultural workers to understand the modern agriculture, agricultural products, experience the modern agricultural production activities. However, the traditional pattern of agricultural training cost is too high, conditions (generally in the field of training), training time, place, not flexible, as well as the training lack of immersive greatly restricting the agricultural training and experience[1]. Firstly, the article introduces the development of agricultural virtual interactive training, technical advantages of the technology of augmented reality and D 'fusion augmented reality development platform frame structure; A strawberry realistic modeling method is given; Then, the article emphasis on the D'fusion-based augmented reality interactive training platform for agricultural technology system framework; Lastly, a typical application employing strawberry as an example was implemented by use of Lua programming language and D'fusion developing platform.

Augmented reality is comprehensive information technology which combines digital image processing, computer graphics, artificial intelligence, multimedia technology and other areas of latest achievements from late 20th century. It is an interactive three-dimensional picture plane by real-time video image transmission and processing of information [2][3]. At present, augmented reality has been in the industrial production, health care and education for the success of applications for entertainment [4] [5] [6].

Along with the advance of technology, multimedia technology is widely used in the field of agricultural training. Multimedia technology by integrating traditional map, text, sound, image and animation for the integration of training forms to stimulate learners' interest and enthusiasm, has the certain effect[7]. But only to learn by visual and auditory ability, cannot express the integrity of the knowledge and lack of interactivity. In recent years, the researchers will augmented reality into the virtual training, and in the industrial training, education and other fields has been widely used in teaching. Use of augmented reality training system to enhance the training students practical ability and knowledge learning ability, improve the training quality. Provide a kind of new learning tool for learners, and has the very big development space [8] [9].

D'Fusion is a AR (Augmented Reality) software products by Total Immersion Company. It is based on the PC platform, quick operation, has a strong compatibility, support for high-definition image input and output, handling D'Fusion real-time information. The D'Fusion provides visual editing of the scene, the Lus script language development, support for 3DS Max / Maya export modeling, image tracking and detection of the video stream, sensing devices access and real-time rendering. D'Fusion Augmented Reality developers to provide excellent technical platform.the D'Fusion Augmented Reality technology framework as Figure 1.
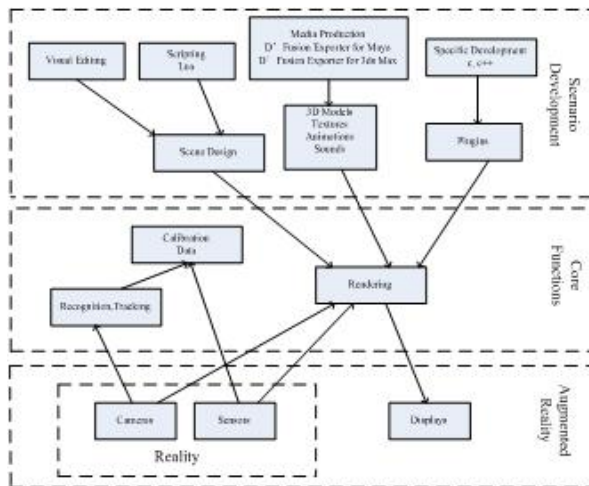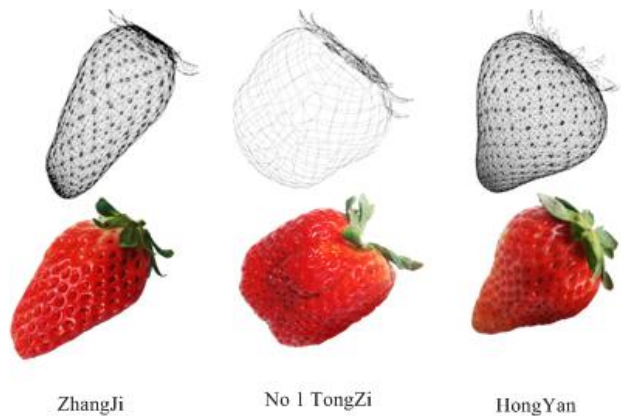

Fig.1. D'Fusion Augmented Reality

Fig.2.Strawberry model

Modeling Method

Plant structure is more complex, however, more details, so using commercial modeling software 3ds Max and Maya to plant modeling is a laborious job. For plant organs the parameterized modeling can not only save time, but also control triangle surface number. Zhao Lili etc[10] used ball B-splines based method for modeling the shape of strawberry organs, the generated morphological models have realistic effects. In this paper, using the method of parametric modeling for three varieties of strawberry which are ZhangJi, HongYan, and No 1 TongZi,which has a good sense of reality. Strawberry grid model and corresponding rendering model as Figure 2.

Based on Augmented Reality agriculture virtual interactive training structure

Based on Augmented Reality agricultural virtual interactive training system, consists of five-layer structure: the model base layer, the interaction layer, the display layer, the Agronomy data support layer and computing processing layer as Figure 3,specifically as follows:

The Model Base Layer, it includes 3D models, animations, audio, and video. which is the virtual interactive data for agricultural Virtual Training system.The Interaction Layer, The use of augmented reality technology development, peripherals camera is basic peripheral equipment, Video information captured by the camera is a realistic source of information, but also based on the image information interaction interactive tools. Currently, relatively mature image-based interactive technologys have simple gesture-based interaction, face recognition-based interaction, two-dimensional image-based interaction, two-dimensional code-based interaction, entity model-based interaction and so on. Meanwhile, to improve tracking accuracy by The data gloves sensor tracking devices.The Display layer, Depending on the agricultural virtual interactive content, you can use the display as a PC monitor display, multi-channel projection display, and tablet computers, smart phones and other mobile terminal display.The Agronomy data support layer, The Agricultural data is the core content of interactive training in agriculture virtual interactive training. To create virtual interactive training technical specifications through the establishment of agricultural knowledge model, process control model and related agricultural Constraints.The Computing Processing Layer. Based Augmented Reality agricultural virtual interactive training

system is mainly used in data processing for video data based registration, tracking, data alignment and integration of the virtual. D'Fusion Augmented Reality technology development platform have good solutions for these key technologies.
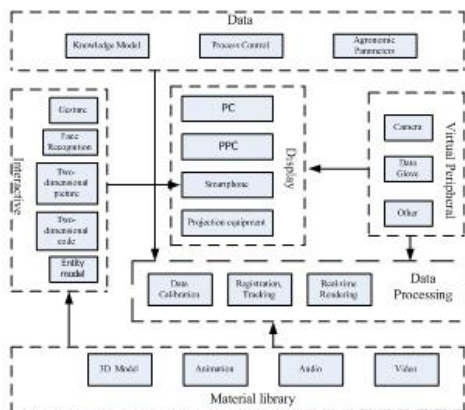

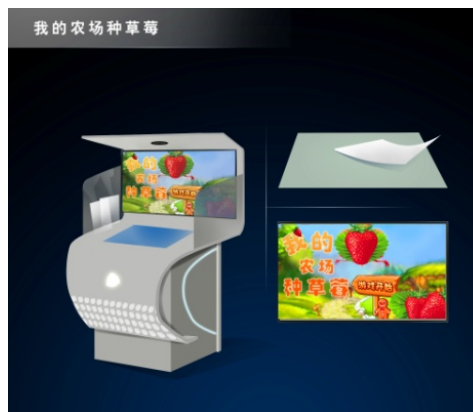Fig.3. virtual interactive training structure

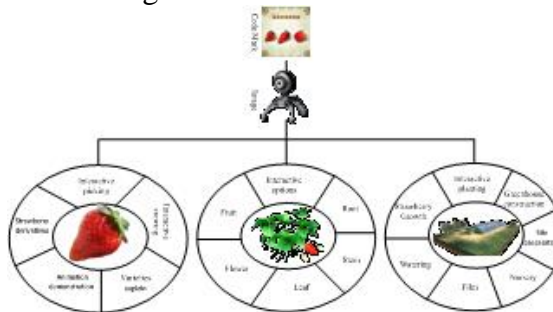
Fig.4. Booth structure

Figure 5 System interface

Fig.6. Interaction form

System development and Application

System based on D'Fusion development platform by Lua scripting language development, using common hd camera, and the test platform is compatible PC machine whose processor is P43.0, memory is 1G, operating system is Windows the XP. The interaction booth is shown in Figure 4.

Strawberry is a kind of suitable for picking fruits, is loved by the masses. The training system as the carrier strawberries, strawberry knowledge content, augmented reality technology means, education and training on the question of the relationship of the general public through the form of a virtual game. Develop an augmented reality-based strawberry virtual training system. The system interface is shown in Figure 5.

The system interactive control the game by the pictures, using the two-dimensional image of the spatial position in the video information as control condition based on image detection technology. The interaction form is shown in Figure 6, as follows: Image-based strawberry picking game; In the game scene, different varieties of strawberries are randomly whereabouts, you can move the card to pick strawberries. After the success of picking, picked strawberries 3D rendering model presented in the scene. You can appreciate the variety strawberry detail features by rotating the card, at the same time with the varieties of strawberry knowledge via voice and video. Image-based strawberry plants game; In the game scene, you can Interactive control strawberry plants in the virtual scene by card, watching strawberry plants structure in the form of a three-dimensional animation, watching the various parts of the strawberry plants details by rotating the card. The same time, by moving the card to make the scattered isolated strawberry plants (roots, stems, leaves, flowers, and ear) regression. In each control process will be accompanied by audio explanations. Image-based strawberry cultivation game; In the game scene, virtual interactive operation strawberry cultivation process, to train strawberries cultivation process in the greenhouse, including laying equipment, soil preparation, watering, fertilizing, seeding, coating and strawberry growth.

Conclusion

In conclusion, Augmented Reality is an effective interaction way for virtual training as well as other virtual reality applications. We used Augmented Reality technology in agricultural virtual training, and presented an interactive virtual training system based on Augmented Reality. A typical application employing strawberry as an example was implemented by use of Lua programming language and D'fusion developing platform. The application included direct and convenient interface for users which allowed users control the inside objects by a solid mark or a piece of image card. In our work, we extended the applications of Augmented Reality in agriculture and provided an effective virtual training tool with novel I/O interactions. However, our system just implemented the functions aiming to strawberry, thus it is not enough for more extensive agriculture applications. We focus on the training content and system as the future works including other well attended plants such as maize, rice, wheat, tomato and so on. The simulation reality interest and immersion of interaction are directions for further improvement.

Acknowledgement

References

[1]H.L.Li, Analysis of Virtual Reality Technology Applications in Agriculture,The International Federation for Information Processing, Vol.258, pp.133-139, 2008.

[2]S.P.Kang,Study of the key technology of augmented reality,Sheng Yang Institute of Aeronautical Engineering,2009.

[3]M.Chen,Research on Some Key Problems of Virtual and Real Interaction in Augmented Reality,Shanghai University ,2009.

[4]Ronald T.Azuma,A Survey of Augmented Reality,Teleoperators and Virtual Environments, Vol.6(4) ,1997.

[5]Allison Kealy, Stephen Scott-Young, A Technology Fusion Approach for Augmented Reality Application, Transaction in GIS, Vol.10(2) ,2006.

[6]Reitmayr,Gerhard,etc,Real-Time Detection and Tracking for Augmented Reality on Mobile Phones, Visualization and Computer Graphics, Vol.16(3) , 2010.

[7]H.J.Jin,Q.Xia,J.Gu,J.J.Xiao,Application of multimedia CAI in agricultural training,Journal of Nanjing University of Seienee and Teehnology, Vol. 5,1993.

[8]B.Y.Zhang,R.W.Yun,Investigation on augmented reality technology and its application in teaching,Experimental Technology and Management, Vol.27(10) ,2010.

[9]Billinghurst, M. Augmented Reality in Education,[EB/OL] http://www.newhorizons.org/strategies/technology/bill-inghurst.htm,2003.

[10]L.L.Zhao,W.L.Wen,etc,Techniques for Modeling 3-D Shape and Realistic Rendering of Strawberry,Chinese Agricultural Science Bulletin, 27(6),pp.201-205,2011.