



DEVELOPMENT OF VIRTUAL WALKTHROUGH SYSTEM OF CHINESE HERBAL SLICES WORKSHOP

¹ XIANG CHAOYANG, ²CHEN XIAONI, ³ZHUANG YIXIU

¹Sr. Engineer, Education and Network Center, Guangdong Food and Drug Vocational College, Guangzhou, China

²Lecturer, Education and Network Center, Guangdong Food and Drug Vocational College, Guangzhou, China

³ Prof., Chinese Traditional Medicine Department, Guangdong Food and Drug Vocational College, Guangzhou, China

E-mail: xiangcy@gdyzy.edu.cn, chenxn@gdyzy.edu.cn, zhuangyx@gdyzy.edu.cn

ABSTRACT

Practical teaching plays an important part in higher education, and also brings some difficulties. One of the difficulties is that the condition of experimental and practical trainings can not satisfy the current requirement of teaching. On account of this problem, this paper introduces a case of developing the virtual walkthrough system of Chinese herbal slices workshop. In this case, it explains the methods and techniques to construct virtual simulation walkthrough system with Quest 3D. For the system can be easily and quickly developed, this case can be an object lesson for similar or relevant instructional activities.

Keywords: *Quest3D, Workshop Roaming, Scenes Changes, Virtual Simulation*

1. INTRODUCTION

Practical teaching is an important session for training technical and skilled talents. It is necessary for students of pharmaceutical technology of Chinese herbal specialty to fully understand and comprehend the producing process of Chinese herbal slices in a workshop. However, restricted by the experimental and practical trainings condition, many colleges have no GMP slices workshop for practical training. If virtual reality can be applied for Chinese herbal producing training, and used for developing virtual scenes and equipment, the situation will be quite different. Virtual reality can solve some problems with its interactivity, immersion and imagination. [1][2]

Walkthrough system of virtual Chinese herbal slices workshop provides a virtual scene with sense of reality and immersion for students. It not only solves the above difficulties, but also motivates students' interests; saves a large cost on experimental and practical trainings; and improves the effect of experiments and practical trainings. In this case, firstly, use 3DMax for building factory and equipment models; secondly, apply Quest3D to build virtual simulation scenes. After that, make use of Walkthrough Camera to roam in the virtual workshop, and reconstruct the logical channel

group of Walkthrough Camera to achieve scenes changes.

Quest3D, developed by Act-3D, is a real-time graphics rendering tool which can be used for 3D display, scenes roaming, virtual training and other functions. The most important characteristic of Quest3D is using modules to compose programs. These modules are called channels, and each channel has special functions. By using these channels, 3D scenes and scenes roaming can be achieved without complicated programming. [3] Quest3D creates gorgeous scenes with the help of DirectX Engine, and occupies fewer resources. This software also provides physical engine, path animation, database connection, networking support and other strong functions[4]. Combining with the producing process of Chinese herbal slices is fluent and strict, and taking interaction between users and system into account, choose Quest3D for developing the system. [5][6]

2. WORKSHOP AND EQUIPMENT MODELING

Chinese herbal slices workshop is an important part in the process of Chinese herbal pretreatment. It contains bolting compartment, selecting compartment, washing compartment, moistening compartment, cutting compartment, drying compartment, calcining compartment, stir-frying

compartment, stir-baking compartment, steaming compartment, herbal slices production line, QC lab, intermediate station, inner packing compartment, outer packing compartment and other nearly twenty operating posts. Therefore, the crux of the matter is whether a reasonable model can be built or not. If the model is over-sophisticated, it will look like an authentic one, but slow down the computer for occupying too many resources and even the model cannot be imported. If the model is over-rough, it will be lack of sense of reality and immersion for students. To solve this problem, according to GMP and characteristics of Chinese herbal slices workshop, we have worked out the following rules for the virtual system: the door of every operating post is close, so that visitors are not allowed to get in, but can watch equipment inside by the windows of outer corridor and cleaning corridor; visitors are allowed to enter the workshop of herbal slices production line post when breaking rules.[6][7] That is to say there are three scenes: visitors can walk through the outer corridor, cleaning corridor and herbal slices production line post.

This system use 3DMax for modeling. According to the rules above, should pay more attention to the following matters when modeling: firstly, establish the overall model abstractly, this means to focus on "simple" models, display only main lines, mind the alignment based on "dot", reduce accumulating blocks, avoid overlapping and intersecting planes, and try not to use Boolean operation; secondly, when modeling, simplify the equipment models which can only be watched from a long distance, and finely establish models of the herbal slices production line post which can be observed closely, and omit equipment models which cannot be seen. The established overall model (Fig. 1) is about 3.7M. Then export this document named CF.X.

3. ESTABLISH WALKTHROUGH SCENE BASED ON 3D

3.1 Establish Basic Scene

Import the CF.X document into Quest3D, and create a module named CF. After that, add a 3D scene module and a render module. Set the 3D scene module to be a start module of the channel group, and add four point lights. Finally, connect the above modules with the channel group (Fig. 2), in order to form a walkthrough scene of the virtual Chinese herbal slices workshop.

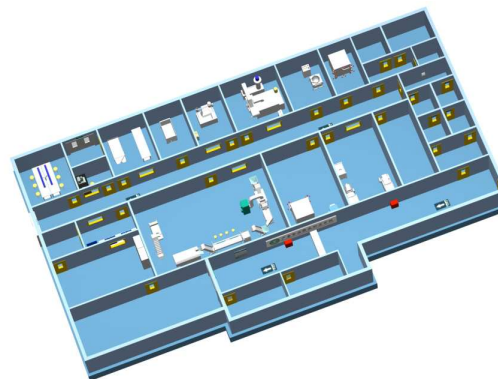
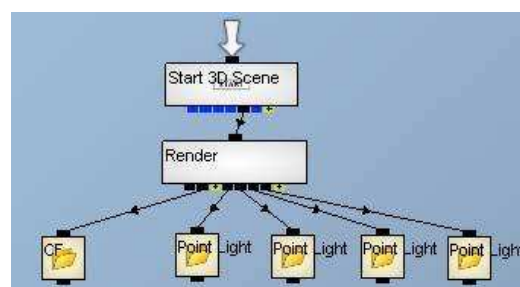


Fig. 1 Model Of The Chinese Herbal Slices Workshop

Fig. 2 Channels Of The Scene Of Chinese Herbal Slices Workshop



Adjust the size, direction and position of the factory in the animation window, and adjust the position and intensity of lights by checking, until the exhibition of the factory and equipment is fine.

3.2 Implement Walkthrough And Check Collision

Add Walkthrough Camera module, and connect it with 3D scene module. This "camera" is an important tool for workshop roaming. Users are allowed to walkthrough in the workshop according to their own route by moving the mouse. [8] Adjust the position, direction, height and focus of the camera in the animation window, and switch into Project Camera to check the result until the exhibition is fine. Adjust Y value to set the height of Walkthrough Camera by Collision Spheroid Radius module. Adjust the speed of Walkthrough Camera by Speed module. To enhance the simulation result of the walkthrough system and

avoid penetration, it is necessary to set Collision Checking.[9] When opening the Walkthrough Camera Channel Group, there is a CollisionObject module which can be used for Collision Checking. Set up a shortcut for the CF module, and then connect it with the CollisionObject module (Fig. 3).

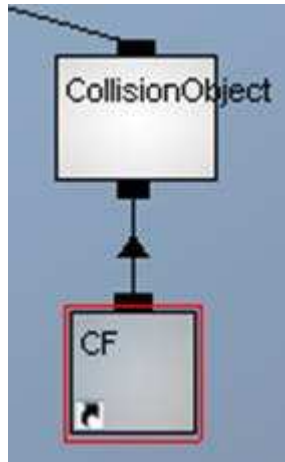


Fig. 3 Connection of Collision Check Module

True Value, the Set Vector will execute once to send the value of Value Vector to Out Movement Position module. And position of Walkthrough Camera in 3D space is decided by the value of Out Movement Position module.

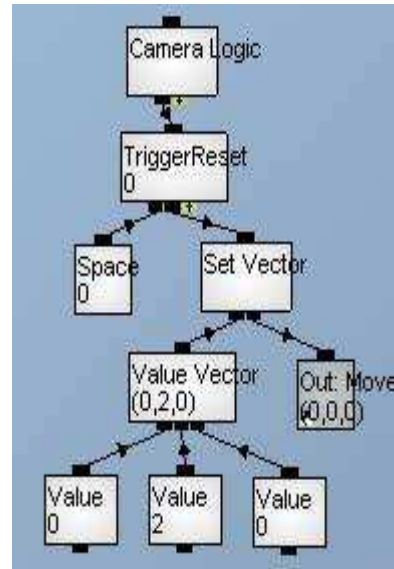


Fig. 4 Logic Channel of Walkthrough Camera

4. WORK OUT CONTROL LOGIC AND GUI

Users' participation plays an important part in this system. After modeling and establishing walkthrough scenes, should pay more attention to interaction.[10] Reasonable control logic can promote friendly interaction between users and the system.

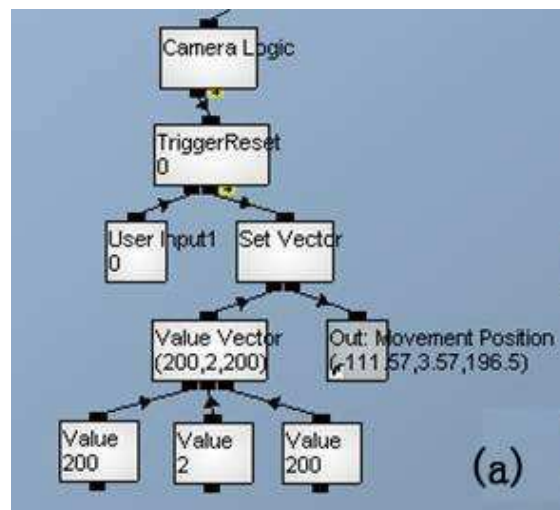
4.1 Work Out Control Logic

There are three switchable walkthrough scenes in this virtual system. The methods of scenes changes are explained below.

In Walkthrough Camera Channel Group, there is a logic channel (Fig. 4). The function of this channel group is that when pressing Space of the keyboard, the Walkthrough Camera will return to the original position. By redesigning and reforming this logic channel group, the Walkthrough Camera can switch among different scenes.

The Space module inputted by user can be defined to capture trigger signal from a key. When pressing this key, the value is "1". When releasing this button, the value is "0". This logical value is inputted into TriggerReset module as a trigger condition. After the TriggerReset module receiving

Copy twice to get two more Channel Groups with the same 3D scene module, after deleting the One Time module of the Camera Logic Channel Group. Set these three User Input modules to respectively capture the trigger signal from the keys of "1", "2" and "3" of the keyboard. After testing time and again, respectively set the value of these three User Input modules to be (200, 2, 200), (200, 2, -140) and (200, 2, 0). The logic structure after setting is shown in Fig. 5.



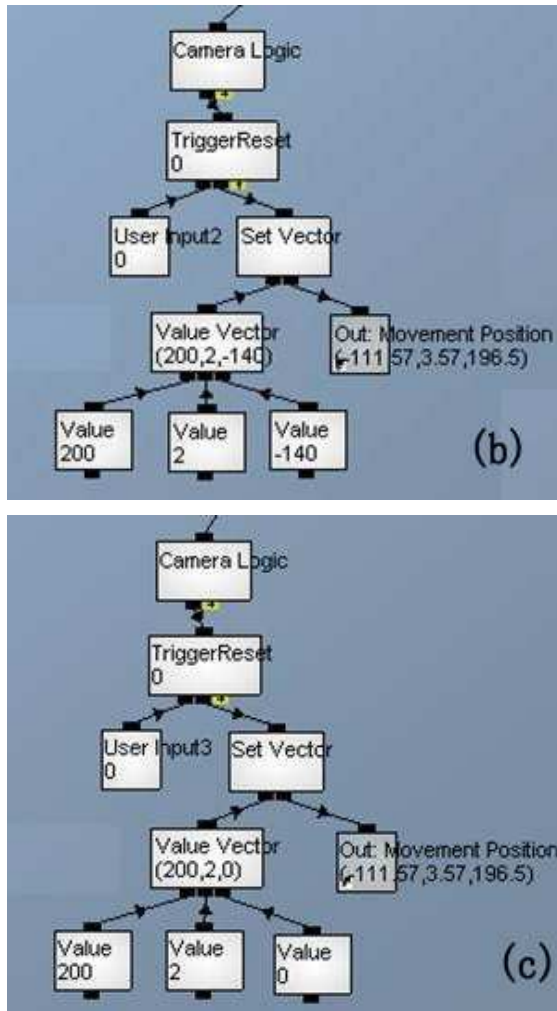


Fig. 5 Control Logic Channel of Workshop Scenes Changes

4.2 Set GUI

To prompt the function of scenes changes, set GUI (Graphical User Interface) as prompt on screen and present the following information: key “1” for outer corridor; key “2” for cleaning corridor; and key “3” for herbal slices production line.

Add 2D Screen Text Channel Group (Fig. 6); set text message in Text module; and then set the text presented position on screen in Position module.

5. PUBLICATION AND ADJUSTMENT OF WEB PAGE

The web page must be published as 1200×668 pixels to satisfy the design of this virtual system, but Quest3D can only allowed to publish the page with the ratio of 4:3. To solve this problem, can design a general formula, and adjust the Y Scale

value of Scene module in Quest 3D according to its result. Set the horizontal axis value of the web page to be X, and the vertical axis value to be Y. When converting according to the size of 4:3, the vertical axis value will be $X \times 3 \div 4$; while the actual vertical axis value of the web page is Y. Set $\frac{X \times 3 \div 4}{Y}$ as a conversion coefficient, and then the

Y Scale value (original) of the scene can be adjusted to be a new one according to the following equation:

$$Y \text{ Scale value (new)} = \frac{X \times 3 \div 4}{Y} \times Y. \quad (1)$$

After publishing the web page in Quest 3D platform, open the index.htm document. Codes are shown partly as following:

```
<body topmargin="0" leftmargin="0" bgcolor="#FFFFFF">
```

```
<script type="text/javascript">
```

```
CreateQuest3DPLayer('my-dx.q3d',640,480);
```

It was evident that the default size of the web page is 640×480. When setting 640 to be X, and 480 to be Y, the web page can be presented in ordinary scale.

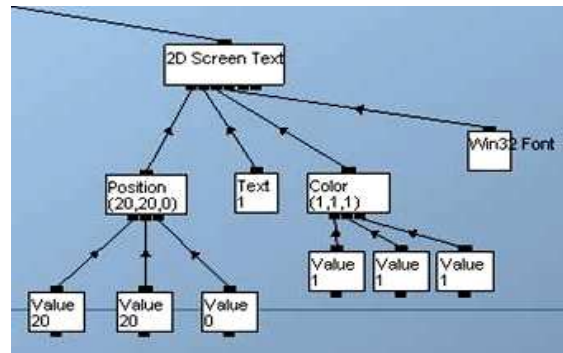


Fig. 6 Channels of GUI

6. RESULTS OF SIMULATION

The capacity of the web page which published in Quest3D is 997KB. At the moment, the virtual 3D scene of Chinese herbal slices workshop is built, and visitors are allowed to roam in it. By pressing the key of “1”, “2” or “3”, visitors can roam among outer corridor, cleaning corridor and herbal slices production line post. Two of the simulation scenes are shown in Fig. 7 and Fig. 8.



Fig. 7 Scenes Of Outer Corridor

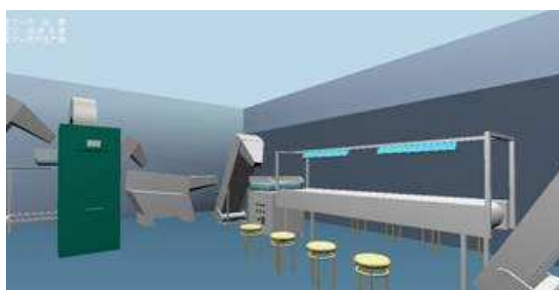


Fig. 8 Scenes Of Herbal Slices Production Line Post

7. CONCLUSIONS

At present, colleges of our country generally have difficulties in practical teaching. Virtual simulation system is a good medicine for solving some of the difficulties. It not only compensates for the weakness of traditional training equipment in practical teaching, but also provides an alternative training way for colleges that have no enough funds for building training workshop. For its high efficiency and ideal effect, Quest 3D is an excellent tool for developing virtual simulation system. The methods and techniques of using Quest 3D explained in this paper are general, and provides references for developing similar or relevant instructional systems.

AKNOWLEDGEMENT:

The authors would like to thank for the support of Research Project of Guangdong Provincial Department of Science and Technology (Project number: 2006B35604008), Guangdong Food and Drug Vocational College (Project number: 2007016), Guangdong Education and Research (Project number: 2010tjk152), Guangdong Universities Technology Research (Development) Center Construction Project (Project number: GCZX-B0905), and Develop Traditional Chinese Medicine Powerful Province of Guangdong Chinese Herbal Bureau (Project number: 20112174).

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