Design of the MFC& Flash-based Visualization Stage Management System

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Abstract. This paper employs the ShockWave Flash Object controls to realize the communication between MFC and Flash. The SWF files are embedded into MFC projects and the frame switchover are controlled by packaging functions. A visualization software for stage management is developed based on that technology.

Introduction

In order to achieve successful performance, a stage manager is needed to coordinate the Stage Lighting, Stage Sound, Stage Machinery. However, traditional stage manager can only rely on eyes and ears to see and to hear whether the stage sound, lighting and stage machinery are working properly. This kind of work is of low efficient, and can't rule out potential malfunction during rehearsals. Modern stage technology, therefore, is in urgent need of a digitized stage management system that can show the malfunction of the stage machinery. With this technique, three systems—stage lighting, sound, and stage machinery can be integrated together. Stage manager can monitor all the equipment running statuses on the stage, and can take remedial measures as soon as possible when there is an equipment failure. The ShockWave Flash Object control is applied in this paper. The operating data of the stage lighting, sound and stage machinery can be integrated efficiently, and status of all the equipment in the stage can be shown vividly.

Microsoft Foundation Classes (MFC), is a kind of class library provided by Microsoft. It is packaged by Windows API in the form of C++ class. It contains an application framework to reduce the workload of programming personnel. The classes involved contain a large number of Windows classes and many Windows built-in controls and package classes of modules.

Flash is an interactive vector multimedia technology. It is a kind of integrated creation software with the animation creation and application development in a body. It provides a full-featured creation and editing environment for creating digital animation. As a kind of high-end application, Flash creators provide some executable scripts instructions and extended interfaces to adapt to the industrial-grade animation production. Just by installing the FLASH player, users can directly browse FLASH content and don't need to download and install the plugin.

Besides embedding Flash into MFC, unity3d can also be an option. However, unity3d is mainly used for 3D model, and the implementation is difficult to operate with complicated code quantity. 2D animation is enough to show the equipment working process on the stage. so it is more convenient and simpler with Flash.
Communication Ways of MFC and Flash

Communications between Flash and external program can apply the functions of the ShockWave Flash Object function control [3]. All the classes functions of the control can be called after the ShockWave Flash Object controls are Embedded in the MFC and a member variable is given to the control association. Now communication between MFC and the Flash is divided into two parts. The first part is sending messages to outside engineering by Flash. The second part is getting messages from Flash. Corresponding to these two steps, FSCommand (command, args) and Get Variable () and Set Variable () implementation are in control.

Adding Shockware Flash Object Control

To embed the Flash animation, MFC should add the shockwave Flash object controls into the MFC project. The process is as follows: Make sure the system has equipped with Flash first. After establishing the MFC project, choose registered Activex controls in the control bar. Choose the shockwave flash object, click insert to enter into the project, then add a class in the project for this control, and generate an object of the control. Insert the controls to "your own", an icon will appear in the VC dialog editor, and this is the control icon. Drag the icon to the performance period and associate it with an object, then the Flash control is embedded into the MFC project successfully.

Flash Sending Messages to External Projects

As shown at Fig. 2. Users can use the FSCommand (command, args) function in the ShockWave Flash Object controls to send messages to outside Flash. Its two parameters form character strings. For example, pressing the button A can send message: FSCommand ("button", "buttonA"); and pressing the button B can send FSCommand ("button", "button B"). Based on the two parameters of different strings, the Flash program can determine which button the user pressed after receiving the FSCommand message. By using this function, messages can be actively conveyed to external projects in Flash animation.

External Projects Receiving Messages from Flash

Function CShockwave Flash: Set Variable (LPCTSTR name, LPCTSTR value) can set the value of the variable in Flash. The value can be the property of the elements in Flash, such as the size, rate of play, and transparency etc. The parameter ‘name’ is a property’s name of a component in Flash files under a certain situation; value is the given number, for example, to change the value y in the BottonA coordinate in the root situation into Y, it should written into Set Variable("_root. BottonA._ y", Y). It is notable that value is a string parameter; therefore, Y should be transformed into CString.
How to Control the Flash Play

We all know that Flash is played by frame, while movies are played as the sequence of the films. Since eyes have the features of visual stopping, the picture is moving when played at this speed. So does the animation production. When it comes to Flash, one flame equals to one film. Controlling the Flash means to control the flames of the Flash.

Loading swf Files

The function m_Flash Player. Load Movie (from the pathway of 0, //flash) in the ShockWave Flash Object control can be used to load Flash files.

Control the Flame of Flash

Flash is played from the first flame to the last one by default. What we should do is to let the Flash change with the received data. For example, the main elevating stage is located at 3m, and it has to be lifted to 5m first and then dropped to 1m as ordered.

```javascript
//External projects sending messages to set the main elevating stage at 5m.
Set Variable("_root.ElevatingStage._y",5)
//Check the current position of the main elevating stage.
Y = Current Position("_root.ElevatingStage._y")
//When the current position is at 3m, it should be in “up” state.
Elevating Stage. Go To Frame(up,5)
// Send another order to down the main elevating stage to 1m.
Set Variable("_root.ElevatingStage._y",1)
// Check the position and change the state into “down”
Y = Current Position("_root.ElevatingStage._y");
Elevating Stage. Go To Frame(down,5);
```

Following is the illustration of the equipment working state of the stage and the CUE chart.

<table>
<thead>
<tr>
<th>Time</th>
<th>Stage Machinery</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10sec</td>
<td>Main Stage</td>
<td>Move to 5m</td>
</tr>
<tr>
<td>20sec</td>
<td>No.1 Light</td>
<td>Change into Yellow light</td>
</tr>
<tr>
<td>40sec</td>
<td>Sound</td>
<td>Amplify the sound by 5dB</td>
</tr>
<tr>
<td>50sec</td>
<td>Main Stage</td>
<td>Move to 3m</td>
</tr>
<tr>
<td>1min 10sec</td>
<td>No.1 Light</td>
<td>Change into Blue light</td>
</tr>
</tbody>
</table>
Since the Flash file is played frame by frame, the frame jumping instruction should be used when Flash needs to jump to nonadjacent state. For example, each of the lighting Flash file has 50 frames, including the weak-strong-weak process. When changing the Flash file from red light to yellow light, following instructions should be acted:

Y = Current Position("_root. Light._Clr") //Checking the current position of light
Z = Y + 50 * W // positioning the frame that needs changing.
Set Variable("_root. Light._Clr", Z) //Jumping to the corresponding frame.

When the main stage has 200 frames, and up the Flash from 3m to 5m and then down to 3m again, the following operations are needed:
Elevating Stage. Go To Frame(up,5);
Elevating Stage. Go To Frame(down,3);
Specific animation play sequence in this setting is as Fig. 3.

![Figure 3. Animation Playing Diagram of Stage Machinery in the Setting.](image)

The scheduling system analyze the feedback data from stage machinery, stage light and stage sound subsystem, then the operation will be completed by calling interface function in the ActiveX control, triggering corresponding events, sending data to the stage scheduling system and receiving command from it. After the receiving data are unpacked and compared, the stage scheduling system will send out fault warning in real time if there is an error. Interface of the software is shown in Fig 4.
Conclusions

This paper achieves the communication between MFC and Flash with the ShockWave Flash Object control. The packaging function is used to control the jump of SWF frames, with which a stage management software is developed. In practice, the MFC and Flash are highly integrated. Flash can show the working status of the equipment exactly with small time delay. This technology can provide good visual supervision for stage management.

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