Multi-layer Based Authoring Tool for Digilog Book*

Jonghee Park and Woontack Woo

GIST U-VR Lab.
500-712, Gwangju, S. Korea
{jpark,wwoo}@gist.ac.kr

Abstract. In this paper, we propose multi-layer based authoring tool for Digilog Book. The main feature is that a user can author some properties of printed contents of a paper book. Those properties can be utilized for virtual contents authoring. The proposed authoring tool provides an interface to allocate some properties for printed contents. Those properties are utilized in manipulating virtual contents. As a result, users can author a realistic Digilog Book.

Keywords: augmented reality, authoring, layer, AR book, Digilog Book.

1 Introduction

Digilog Book [1] is an Augmented Reality (AR) book which provides additional information by stimulating human's five senses with multimedia contents. Digilog Book provides not only analog emotion of physical book, but also five senses experience of digital contents by combining advantages of paper books and multimedia content. The knowledge navigator [2] showed a good example in aspect of interaction between *Digilog Book* and human.

Several AR authoring tools have been proposed. Mobile Augmented Reality System (MARS) [3] introduced time line based authoring for a mobile AR. It provides Graphic User Interface (GUI) for non-programmers. If user attaches several multimedia contents to specific location in virtual space, end users can experience those contents in outdoor environments using a Head Mounted Display (HMD). Immersive authoring system for Tangible Augmented Reality (iaTAR) [4] introduced a component-based immersive authoring method. User can manipulate virtual objects by various tangible pads. However, previous works only focused on authoring properties of virtual contents without any considerations of contents in real space. Therefore, previous authoring tools are general purposed authoring tool. In addition, there are no currently authoring tools available for Digilog book from our knowledge.

In this paper, we propose a multi-layer based authoring tool for Digilog Book. The main feature is that a user can author some properties of printed contents

of a paper book. Those properties can be utilized for virtual contents authoring. The proposed authoring tool provides an interface to allocate some properties for printed contents. As a result, virtual contents can be highly related with printed contents of a paper book.

2 Multiple Layers Based Authoring Tool

The proposed authoring tool is based on natural feature tracking method [5]. The architecture mainly consists of two components. The first one is a multi-layer based authoring system. The other one is Digilog Book viewer. In multi-layer based authoring component, it recognize a page number from camera input images using SIFT [6] features. After recognition phase, a user can start authoring tasks on the page via layer creation module. A user creates many layers by provided layer templates in layer creation module. Then, a user has to allocate some properties on each layer. The authoring information is stored in page manager module as a XML format. In Digilog Book viewer, it recognizes a page at real-time from camera captured images. After the page recognition, it loads a corresponding XML file from database and construct scene graph based on it. Finally, corresponding contents are augmented and a end user can interact with Digilog Book.
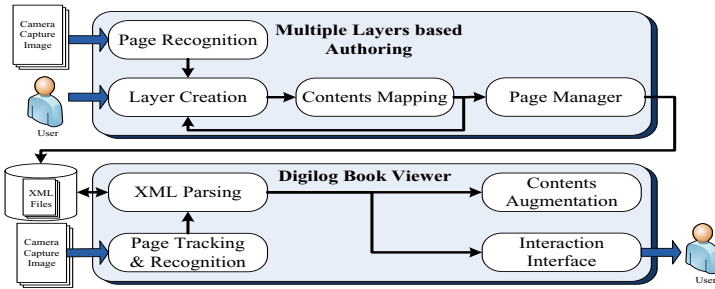

Fig. 1. Overall Architecture

Authoring tasks are accomplished simply by a repetitive process. A user generate multi-layer on each orthogonal image. For creating a layer, the authoring tool provides two types of layer templates: circle and rectangle shape. It makes creating layer task easy because a user can create a layer minimum number of control points. For more complex shape of layer, user can make a polygonal shape using a number of control points. After creating multi-layer, users have to allocate its properties such as transparent rate, layer level, and so on. As table 1 shows, layers can be categorized into two types: a contents layer and a description layer.

The properties of description layer are meaning of printed object on paper book. Description layers can be used for making relationship between virtual
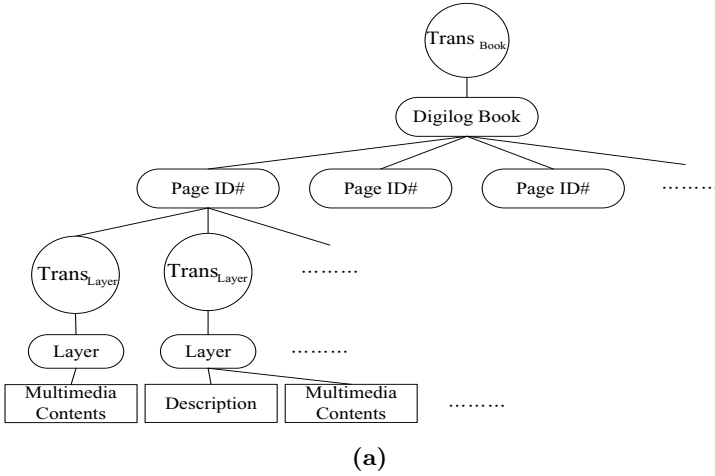
Table 1. Types of Layer and its Property

Type	Detailed Type	Property
Contents Layer	Video	Play Timimg, Frequency
	Sound	
	Picture	Brightness, Chroma
	Text	Font, Size, Color
Description Layer	Description	Object

contents and printed contents. In addition, users can author multimedia contents to a specific layer. The contents layer is for augmentation of multimedia contents. The contents layer is mapped to specific contents file. The properties of each contents layer represent mapping information between contents and layer. It contains contents type oriented attribuions and event which is applied in Digilog Book viewer. Figure 2 shows the concept of description multi-layer. The layer level represents a distance from a page. For example, level three layer is placed at higher position than level two layer. Therefore, a user can define occlusion between multi-layer as if multi-plane exists in a three dimensional space.
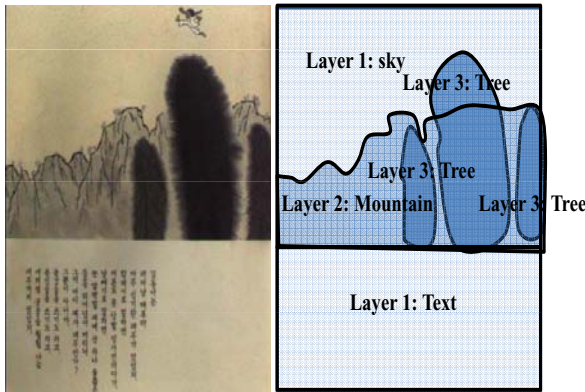
Fig. 2. Description type of multi-layer of picture area

As shown in Figure 3(a), multi-layer has a hierarchical data structure. Therefore, it is well mixed with a scene graph structure which is appropriate for 3D rendering. When a user finishes authoring one page, user has to input the page number which identifies each scene graph. The authoring information including the page number is stored as a XML form for extensibility and readability for a non-programmer user. Figure 3(b) shows an example of video contents mapped to a rectangle type of layer on page number two.

(a)

```
- <Page_Layout>
  - <Page num="2">
    - <Area type="video" shape="rectangle">
      - <Position>
          <LeftTop x="145" y="75" z="-0" />
          <RightBottom x="275" y="-22" z="1" />
        </Position>
        <Timimg>Automatically</Timimg>
        <Frequency>Repeat</Frequency>
        <FilePath>D:\cow.mov</FilePath>
      </Area>
```
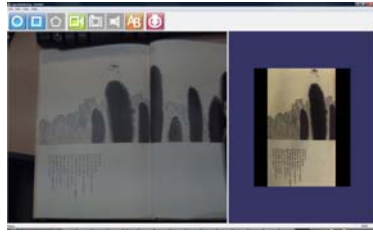
(b)

Fig. 3. Authoring : (a) authoring a transparent layer with level 2 and 2D animation path with level 1 (b) its result in a Digilog Book viewer

3   Implementation and Result

We developed our system on a 2.66GHz CPU with an NVidea Quadro FX 4600 graphic card and 4 GB RAM. The proposed authoring tool is based on MFC for GUI interface. For rendering virtual contents, OpenSceneGraph (OSG) [7] is used. MSXML [8] is used for storing data.

In AR space, user's mouse input can be different according to view point because mouse input is performed in two dimensional space. Therefore, an orthogonal image of each page can be helpful for accurate user input. For that, we used reference images which are used in the page training process of markerless tracker. In addition, we provided a GUI which a user is already familiar. Figure 4 shows the user interface for the proposed authoring tool. Users can author multimedia contents in desktop environment using menu buttons on top of the main window. The main window is divided into two views. Left view shows video stream from a camera for AR view and right view shows the corresponding orthogonal image in VR space.

Fig. 4. GUI of proposed authoring tool: Left part is for an AR view and right part is for an VR view
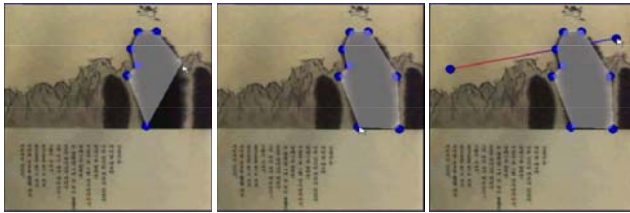
(a)

(b)

Fig. 5. An example : (a) authoring a transparent layer with level 2 and 2D animation path with level 1 in VR view (b) its result in a Digilog Book viewer

Figure 5 shows an example of multi-layer authoring. Figure 5(a) shows an authoring process in VR view. At first, an user created one layer along the printed black tree. After that, the user made a 2D animation path with a sun image behind the tree layer using a lower layer level. End users can see the Digilog Book on a monitor in desktop environment with a USB camera. It was shown as figure 5(b) in Digilog Book Viewer. The sun was seemed to pass behind the printed black tree.

4   Conclusion and Futurework

We proposed multi-layer based authoring for Digilog Book. The main function-ality is that it considers contents of physical book as well as virtual contents. It

is helpful to make a relationship between virtual contents and printed contents of a paper book. In implementation section, we showed an example of realistic augmentation using proposed authoring tool. As a future work, we will consider some higher level authoring for Digilog Book such as storytelling, event authoring, and haptic authoring.

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