An Analyzer of the User Event for Interactive DMB

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Abstract. The interactive digital multimedia broadcasting stands for a convergence application between digital multimedia broadcasting service and wireless internet service. It develops MPEG-4 BIFS (Binary Format for Scene) technologies which is standard component of associated data service for DMB. In this paper, we propose system architecture of the interactive DMB, called the interaction manager. The interactive DMB facilitates to transmit interactive contents and user can easily use these contents by clicking or typing some additional information. The proposed interactive DMB system can capture and response user interaction information by using the return channel. In this paper, we are mainly focused on extracting the event data of the user interaction on the device. We suggest an analyzer to catch the user event and transform into a specific format for bidirectional DMB service system.

1 Introduction

The interactive DMB is the new trend and interesting research in nowadays. The user will not be a receiver only but also he can interact by using the interactive DMB service system. User can directly interact with the advertisement products or retrieve the additional information. For that reason, the interaction between the user and the server is the important part to think for this kind of bidirectional service.

The earliest research was only emphasized on the whole part of the system and without detail considering about the interaction between the user and the server. They did not explain detail about the steps to develop this system. We imply the system architecture of the bidirectional DMB data service and describe how the user communicates with the DMB server and how the DMB servers can response to the user's requirements.

In this paper, we propose the idea that the interactive DMB service system and discuss each module of this system. Especially, we analyze the user event from the interaction part of the interactive DMB system. This is based on the BIFS of the MPEG-4 contents, which is the system level. In this part, the extraction of the user information is important and basis of the interaction of the DMB.

The rest of this paper is organized as follows. In section 2, we discuss about the related works of the DMB system, we introduce and describe the interactive data service for DMB system in section 3. In section 4, we describe about the user event analyzer, which is the first module in the proposed interactive DMB system. Finally, we conclude the paper and we give a note on our future work.

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2 Related Works

The current TV broadcasting also provides the interactive service indirectly, such as quiz program and voting based on viewer's feedback over telephone lines. In [4], Jitae Shin and others developed an interactive DMB system based on the MPEG-4 BIFS for bidirectional services. They provide the typical scenarios and corresponding data in detail for interactive DMB services and introduce the current TV broadcasting services to a direct mode by using a BIFS mechanism installed in the DMB terminal. [4] Before that B.Bae and other proposes a T-DMB extended wireless Internet platform for interoperability (WIPI) over a code division multiple access (CDMA) system for the return channel. Some paper focuses on the transmission of the DMB system.

The interactive DMB system can be categorized into three types. The user can interact with the server by the web browser, sending and receiving SMS messages or using return channel, for example CDMA cellular network, a wireless local area network (WLAN) in a hot-spot service area etc. In order to operate these environments, we need to set the protocol of data transfer in the return channel.

For the bidirectional data service via web browser, it needs the additional web server to support and manage the web site, contents and user information. User can be easily linked to the specific web site from the contents received by the server. It is possible to be implemented by ahchor node supported in MPEG-4 BIFS [5]. In the case of the bidirectional DMB system with the web server, the content provider can support lots of complicated services for the users such as, shopping, file downloading, voting online and so on. This kind of interactive service has to provide the site management fee and the web surfing fee. For the SMS service, the system is light weight, simple and easy to be implemented. But the data that can be held by the SMS message is very limited. EMS (Enhanced Messaging Service) was developed to send the rich media contents such as pictures, animation and melodies in original SMS services. It is also less widely supported than SMS on wireless devices. In the case of the return channel, the user can interact with the contents and transmit the user event information to the server directly and response the user event information in real time [7]. To support the bidirectional event, it need the specific protocol between the server (contents authoring tool and streaming server) and the player in user terminal. By using the bidirectional DMB service via a return channel, we proposed to add one main part in the original DMB system to deal with the user interaction.

3 Proposed Interactive DMB System Based on MPEG-4

In this section, we describe the architecture and the operations of the proposed interactive DMB system.

3.1 Architecture

Figure 1 shows the overall structure of the proposed interactive DMB system. In the DMB system, the various multimedia objects composing the contents can be encoded by correspondent encoder separately.

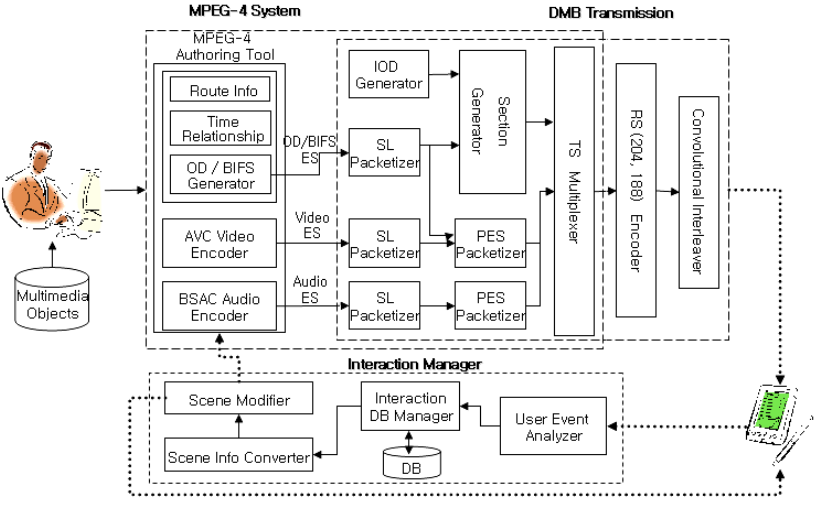

Fig. 1. The User Interactive DMB System with the Interaction Manager

Each elementary stream will go through the synch layer (SL) packetizer, transport stream (TS) multiplexer and it will be multiplexed at one stream. After adding forward error correction code (FEC: RS encoder and convolution interleave), the contents stream finally can be transmitted to the user's terminal [8].

For the bidirectional DMB service via a return channel, we designed a new module, called interaction manager to analyze and transmit user event information to the server. It consists of four modules, user event analyzer, interaction DB manager, scene info converter and scene modifier. The interaction manger can capture and analyze user's interaction from the handheld device and to arrange and return the requested information to the user. In authoring tools side, it needs to add some modification for creating the bidirectional contents. For the player, it needs to parse the scene information to extract the user's interaction information. The user interactions can be performed in two ways, mouse click and the text input. For example, the corresponding scenarios can be secret vote, online vote, commercial information, online quiz, file downloading and so on.

3.2 Operations

3.2.1 User Event Analyzer

In this module, we will extract the user's interaction to transform MPEG-4 BIFS to the requirement data type for the whole system. The user interaction will start when the user interacts with the contents by clicking mouse or type the text. The user interaction can be classified into two types, the interaction between the user and the streaming contents called inner action and the interaction between the user and the server, called bidirectional interaction.

The bidirectional interaction notifier is used to distinguish these two types. We added two fragments to the correspondent nodes ID to identify distinctly. The interaction info extractor will extract the node id of the corresponding object from the use event. If it is a text node, it will also extract the text contents. The information converter will convert the data from the interaction info extractor. It will convert data into the required information such as alternative ID in online quiz program. Information wrapping will bind the converted information with some additional data, such as user ID, content ID, etc. For deciding and defining the user's questions type (i.e., send, retrieve, search), we add one more field named action type. For the detail operation of user event analyzer, we will explain in detail in section 4.

3.2.2 Interaction DB Manager

The main function of the interaction DB manager is to make the decision processes for the user event information.

Simple operation of the Interaction DB Manager

```
begin (Action)
if ActionType= "1" then RetrieveContents ();
    //Information correspondent to the current streaming contents from the database
   // ActionType, "1" for Retrieving the user requested data from the database , "2"
for Searching user requested information, and "3" for Storing the data into the da-
tabase if the user is answering online quiz or online voting
    elseif ActionType=" 2 " then Search();
      //Search the user requested information from the database by given key words
    else Store();
endif
        GetData();//get the data from the database
        DecisionProcess();
         //make the decision using rules and the data from the database
         AddField(); //Info
      if  Info= "Important" then AddFieldTrue(); //Server
          else AddFieldFalse();
     endif
      //Server Reaction Type,true for all users, false for individual user
      if  ActionType='3' then Store();
          else SelectResultInformation();
SendData(); // send data to next step
end.
```

The example output data of the interaction DB manager will be Server Reaction Type, User ID, Contents ID, Question ID, Answer and Statistics (optional), etc.

3.2.3 Scene Information Converter

The purpose of this sub module is to create scene update plan for the user requested information. From the previous module, we already get the decision for the user's event.

```
Simple Algorithm for Scene Information Converter
  begin SceneInfoConverter
      GetOutputData();        //result info from interaction manager
      Select(Decision Info);  // from the info data
  repeat
      {
       AddScene();
       DeleteScene();
       ReplaceScene();
      }
  until  UpdateInfo Finish
      ConvertInfo();
      UpdateBifs();
       SendData(); //send data to next step scene modifier
  end.
```

The example output data for the scene information converter will be Server Reaction Type, User ID, Contents ID, Question ID and BIFS Commands for the Answer.

3.2.4 Scene Modifier

The Scene Modifier has only one main process. The following algorithm shows the processes occurred in the Scene Modifier.

```
Simple  Algorithm for Scene Modifier
   begin (SceneInfoConverter)
      GetData()
      for ( user from 1 to count)
        {
          Get(Time); //time scheduling
          If (User1Time>User2Time)   then Priority=User2
          Endif
        }
     endfor
     if  ReactionType='true' then TransmitToServer();
       else  {
              EncodeData();
              TransmitToClient();     //transmit directly to the user
             }
   end.
```

Output data format of the information for the individual person will be User ID, Contents ID, Question ID and the Encoded BIFS Stream data for the Answer. For the information needed to send to the every user will be User ID, Contents ID, Question ID, and Scheduled BIFS Command for the Answer.

4 User Event Analyzer

In this module, we will extract the user's interaction to transform MPEG-4 BIFS to the requirement data type for the whole system. There are five main parts in the user event analyzer.

The user interaction will start when the user interacts with the contents such as commercial advertisement, shopping request, electronic online voting, online quiz program, secret vote, and file downloading by clicking mouse or type the text. The user interaction can be classified into two types, the interaction between the user and the streaming contents called inner action and the interaction between the user and the server, called bidirectional interaction. The bidirectional interaction notifier is used to distinguish these two types. We added two fragments to the correspondent nodes ID to identify distinctly. A sample algorithm for the user event analyzer is as followed. The Example output data for the online quiz will be, User ID, Content ID, Action Type, Question ID and Candidate ID. The algorithm for the user event analyzer is as shown below.

Simple Algorithm for the User Event Analyzer

```
begin User Event
    if (User Click the contents Display)  then Get Node ID
      {
        if  Frag1 = 'bi'   then {
                                  if  Frag2='0'
                                  then Select "Node ID, Question
                                          Action Type, Candidate ID, etc..."
                                  else goto Begin};
                                }
        elseif  Check Invoker="1"
                  then   {
                           Select "User ID, Content ID, Action Type…"
                         }
        else goto begin
       endif
      }
   else goto begin
  }
 else waiting user action;
end.
```

There are two ways to create the contents display. The contents consist of normal BIFS code or some specific script code. For the first case, when the user interaction occurs, we can only get node ID of the object correspondent to the user event. For this reason, we need to distinguish the outer action and the inner action by this node ID. Therefore the only way to notify the bidirectional action is adding some fragments to the node ID. For the second case, we need to pick up the value of the parameters in VRML script function. When the user interaction occurs, the event information will be stored into this parameter. Using the VRML scripts can be easy to implement the

user event analyzer module. But it is difficult to author the contents in the server side. To notify whether it is outer action or not, we added a fragment to the original node ID. The node ID of the outer action in our system starts from the first fragment. The value of this fragment can be predefined with the authoring tool. The object for the outer action can be divided into two categories. One is the bidirectional start point and the other is the bidirectional interaction invoker. In our system, '0' means invoker and '1' means start point. We used Osmo4 as an open source Mpeg4-player for replaying the MP4 file in the demonstration. This sub system describes capturing the data of the user interaction. We are adding fragment in the normal BIFS data, so we can categorize the bidirectional event or interaction as mentioned above.

And we can also give the example for managing the user requested interaction as follows.

Fig. 2. A Screenshot Example of BouncingRectangle.mp4

This is example of the user interaction. When the user clicks the 'slow' button, the bouncing rectangle will bounce slowest rate as mentioned in the program, 'medium' and 'fast' button will be also working respectively. Additionally, we can see the rectangle translation in there too. This is just we can show that the user event can be captured and we can get the important data from the user event. Our proposed user event analyzer is based on this example and we will extend to develop the second part of the interaction manager.

5 Conclusion and Future Work

In this paper, we designed and added the interaction manager module for bidirectional user interactive DMB system. We explained each sub module of the interaction manager. Moreover, we gave attention on the first module, the user event analyzer and developed the rules to extract the user's interaction. In our example we used the naming technique for checking the inner action or the bidirectional action. We can find

out the user's interaction information and also manage the required data for the remaining steps in the interaction manager. For this implementation we used the open sources for the MPEG-4 standards, GPAC Osmo4 player (GPAC Ver 0.4.2) and OSMO4 Client.

In future, we will continue our research on complete user event analyzer and the interaction DB manager, which is especially making an update plan for reaction information of the server and the command scheduling technique.

References

1. G.Lee, S.Cho, K.Yang, Y.Hahm and S.Lee, "Development of Terrestrial DMB Transmission System based on Eureka-147 DAB System," IEEE Transactions on Consumer Electronics, Volume 51, Issue 1, pp.63-68, February 2005.
2. DMB for Mobile Video for Cell Phone System, Radio-Electronic.com, http://www.radio-electronics.com/info/cellulartelecomms/mobile_video/dmb.php#top
3. net&tv Inc., http://www.netntv.co.kr/pdf/idmb_brochure.pdf
4. J. Shin, D.Y. Suh, Y. Jeong, S. H. Park, B. Bae, and C. Ahn, "Demonstration of Bidirectional Services Using MPEG-4 BIFS in Terrestrial DMB Systems," ETRI Journal, Volume 28, No.5, pp. 583-592, October 2006.
5. V.Ha, S.Choi, J.Jeon, G.Lee,W .Jang and W.Shin, "Realtime Audio/Video Decoders for Digital Multimedia Broadcasting," 4th IEEE International Workshop on (IWSOC'04), pp.162-167, July 2004.
6. M. Grube, P. Siepen, C. Mittendorf, M.Boltz and M.Srinivasan, "Applications of MPEG-4: Digital Multimedia Broadcasting," IEEE Transactions on Consumer Electronics, Volume 47, No.3, pp.474-484, August 2001.
7. Y. He, Ahmad, I.,Liou,M.L, "Real-Time Interactive MPEG-4 System Encoder using a Cluster of Workstations," IEEE transactions on Multimedia, Volume 1, Issue 2, pp.217-233, June 1999.
8. O.Avaro, A. Eleftheriadis, "MPEG-4 Systems: Overview" Signal Processing: Image Communication, Tutorial Issue on the MPEG-4 Standard, Volume 15, No.4-5, pp. 281-298, January 2000.
9. WG11 (MPEG) MPEG-4 Overview (V.21-Jeju Version) Document, ISO/IEC JTC1/SC29/ WGN4668, March 2002.
10. Puri and A.Elefthriadis, "MPEG-4: An Object-Based Multimedia Coding Standard Supporting Mobile Applications," Mobile Network Applications, Volume 3, pp.5-32, June 1998.
11. Herpel and A.Eleftheriadis, "MPEG-4 Systems: Elementary Stream Management," Signal Processing: Image Communication, Volume 15, No.4-5, pp.299-320, January 2000.
12. K.A.Cha and S.Kim, "MPEG-4 STUDIO: An Object- Based Authoring System for MPEG-4 Contents," MULTIMEDIA TOOLS AND APPLICATIONS, Kluwer Academic Publishers, Volume 25, No.1, pp.111-131, January 2005.
13. Open Source, Developer Connection, http://developer.apple.com//opensource/index.html
14. Telecom Paris,http://www.comelec.enst.fr/osmo4/