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MOBILE MIXED REALITY GAMES CREATOR BASED ON MPEG-4 BIFS

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ABSTRACT

In this paper, we propose an authoring tool for creating mobile mixed reality games (MMRGs), referred to as M2RGC (Mobile Mixed Reality Game Creator). Goal is to transform the game creation process in a task that is as interesting as playing the game itself. Therefore we offer a user-friendly interface through which different MMRGs can be created by defining the objects used in the game, their behavior and interaction with sensors (e.g. GPS, compass). The tool itself uses the power of MPEG-4 BIFS[1] capabilities, such as the possibility of grouping multimedia assets in a scene. We build a wrapper over these MPEG-4 BIFS functionalities allowing anyone to discover the experience of MMRGs creation. Concerning the client runtime for playing the game on mobile phones, we deploy a MPEG-4 player on the Windows Mobile and Android platforms.

***Index Terms*—** Mixed reality, Games, MPEG-4, BIFS, Authoring tool

1. INTRODUCTION

In a today's diversity of applications, games have a specific place. They are available in a wide range: from very simple and straightforward graphics view up to sophisticated ones equipped with a complex 3D environment; games that can be played on computers and on mobile devices; games played locally or collaboratively over a network.

Nowadays the trend rises over Mixed Reality (MR) games. In this type of games, as in MR applications in general, the novelty is in combining the real world with a virtual scene, thus incorporating real locations and objects into the game. This gives strong potential for MR games to be personalized and for the game-playing experience to become richer. Furthermore, rapid development in mobile technology and improvement in mobile Internet access increases the number and diversity of applications dedicated for such devices. This technology and related uses are now mature enough to expose diverse positive trends in the development of game applications. The mobile platform works well for MR games because a mobile device goes wherever the player goes, thus the means for interacting with the game is always present. That way, Mobile Mixed Reality Games (MMRGs) become practically borderless and they can be played virtually anywhere and anytime.

However, developing such a game requires profound knowledge in programming, computer graphics, multimedia, logic and artificial intelligence, sensor technology and several other key technologies. Building mixed reality applications for mobile phones additionally requires expertise in specific mobile platforms, including hardware and software knowledge. As a consequence, creating MR games is not an easy task for most engineers that are familiar with these technologies and it is an almost impossible task for people without any technical background. Usually game-scenarists cannot realize their ideas because of the complexity of the system. These facts lead us to go one step further and provide end-users with tools for creating MR games.

In the field of multimedia, the MPEG-4 standard is recognized thanks to its compression capabilities. As a media container it can be used as a programmable language [2]. Having in mind that our objectives are games for mobile devices, an entire game can be contained in a media asset . Furthermore this approach provides some advantages, as for example independence from the platform.

In this paper we introduce Mobile Mixed Reality Games Creator (M2RGC) that allows end-users to create their own MMRGs. The tool is web-based and uses MPEG-4 BIFS as the representative formalism for the game. For running the game, a lightweight version of a MPEG-4 player run on Windows mobile and on Android phones. The rest of the paper is organized as follows. The first section gives an overview of related work in the field. Then the requirements for creating such a tool are listed. Next we present the core of our work, by announcing which kind of games can be created and by presenting the tool itself and explaining the functionality of each of its components. Afterwards the process of using the tool is presented by creating a game. The last section concludes the paper and outlines perspectives for future work.

2. RELATED WORK

Over the past years, several authoring tools dedicated to building MR applications were developed and published by both the research community and industries, allowing regular users to experiment with MR. Not aiming to present a complete survey on MR application creation tools (several of them already exist [3][4]), we only present several approaches for better situating our work.

The AMIRE Framework [5] consists of set of reusable components and visual authoring tool for efficient creation and modification of MR applications. Still, the main attention is around building components with the goal to build repository of structure, reusable and extensive components for easy MR application creation. Additionally, this tool is not indented for users without programming knowledge; builder components sometimes need adaptation and/or combination. The Designers Augmented Reality Toolkit (DART) (2003)[6] is based on Macromedia Director(MD)[7], It extends MD with scripts allowing a user to create complex MR applications. By targeting programmers with previous knowledge of MD and its scripting language LINGO, it is far from being a tool for regular Internet users. The Mobile Augmented Reality System (MARS) [8] consists of a visual editor for authoring MR applications. While the visual editor of MARS looks very promising, the fact that it mainly target to creating MR presentations, it cannot suit our content and specific game-logic creation needs. Some platforms, like Avocado [9] or Studierstube [10][11] try to support authoring on Virtual Reality systems by providing ASCII-based file and scripting formats such as Open Inventor [12], VRML [13] or X3D [14]. All tools presented previously are very complicated to use and require some programming knowledge. In addition, their installation and configuration is in some cases difficult. The most interesting approach and the most related to ours is http://gpsmission.com/, in which it is possible to create a mobile mixed reality game. However, this tool allows only adaptation of one already proposed one game. Thus the user possibilities are highly limited.

The next section presents our M2RGC.

3. MOBILE MIXED REALITY GAMES CREATOR

3.1. Requirements

In order to design and develop an architecture that allows each user of the Internet to become a potential creator of MMRGs, the following requirements should be satisfied:

1. As a particular type of complex media content, games are usually including other types of media content. Consequently each user should be able to create that content; this can be done either on PC by using a dedicated tool or directly on a mobile device by using its functionalities, e.g taking a picture.
2. In addition, to ease the creation process, a repository to share content a be available;
3. One game can be created by one user, but also can be a product of teamwork. It requires user collaboration ;
4. The tool should be interactive, easy to manipulate and powerful enough to create interesting games;
5. Few years ago the main approach was multiple devices, multiple content (MDMC). Today this trend converges to multiple devices, single content (MDSC). The diversity of devices, particularly mobile ones, and their fast expansion are the main reasons for this change. Therefore the created games should be easily accessible on mobile devices, with strong aspiration to support as many platforms as possible.

3.2. Authoring tool architecture

The first version of the tool is dedicated to the creation of "location-based" games for mobile phones that are defined as games that are using maps of the physical world to represent the playing field. A typical game includes map, one or several locations, defined in the tool as non-visual elements such as position and name, and object(s) of interest, visual items holding different pre-built properties such as: position, name, media representation as video, text, icon.. Then the behavior of the game is defined. It includes defining associations between the game elements and between the game element and user location and action. The global overview of our solution is illustrated on Figure 1.

The first task that a game creator needs to do is to define the location area in which the games would take place, and optionally to acquire data associated with that area that latter may be used. In order to do so, we have developed a geographical survey tool (fig 1.a) built using the COSMOS framework[1] [15][16] that implements the location model exposed in the part 3.3 of the article [17]. This tool is a program that is installed for instance on an Android mobile phone. Once launched, it creates a file in which it stores regularly (at a user defined rate) and while the user move, the current GPS position of the phone, the Wi-Fi network it receives, and the GSM cells it detects. The user can then enter a message that will be inserted in the flow of data written in the file so that the data stored in the file could be more easily interpreted, and uploaded (fig 1, b.) to the web server of the web authoring tool, namely www.mymultimediaworld.com. The files obtained are then post-processed to adapt the game to a given area, by creating locations and regions. Therefore this subsystem satisfies the first requirement.

When location files are uploaded on the server, they are compressed to an MPEG-4 format and stored among other MPEG-4 resources (3D objects, images, videos, etc.).

[1] http://picoforge.int-evry.fr/projects/svn/cosmos/

Fig 1. Proposed architecture.

Being a media repository, this web-site answers to the second requirement.

Once the user has chosen the location in which game will take place, the process of adding logic and functionality of the game is next. Therefore, we've build a web-based application available at the following address: http://www.mymultimediaworld.com/authoringtool/test/. (fig 1.c.) Being a web application, this component satisfies the third requirement.

The goal of this component is to generate a MMRG in MPEG-4 formalism. To achieve this it supports the following functionalities:

- define location(s) of interest that include position and description,
- add object(s) with their image, description and some different properties,
- add some behavior(s) for the game logic that follows the event-condition-action model while exposing predefined set of events, conditions and actions,
- add a map that allows visual definition of the game location and its elements.

For each action provided in the tool we defined functions that reflect it in XMT (MPEG-4 BIFS textual representation) formalism. This is allowed due to the nature of MPEG-4 formalism functionalities, as the possibilities to define complex scenes (since MPEG-4 BIFS supports layer composition, grouping of the objects, and can specify the spatial and/or temporal position of objects within the scene), possibilities to include images, text, video, audio, 2D/3D graphics, etc. in games (since MPEG-4 BIFS by its nature allows integration of different media assets), and BIFS mechanism to add behavior to objects and scenes (which is supported by the MPEG-4 ROUTE mechanism in BIFS, as well as the integration of JavaScript by using the Script node). By including this feature, our authoring tool satisfies the fourth requirement.

The game creator does not need to have any knowledge of programming or the MPEG-4 standard, since implementation of all functions are completely hidden from him and only their action is available. Therefore, within this component, the process of game-creation is reduced to actions that define the objects that the user wants to exploit in the game and linking them rationally depending of the game design.

At the end of the creation process an XMT file that contains the entire game behavior and the corresponding media assets is generated (fig 1.d). The file is transferred to the mobile phone and loaded by an MPEG-4 player (fig 1.e). In our architecture we offer an MPEG-4 player implementation based on GPAC[18], which is distributed as open source software. Additionally, for tracking the user position we developed a separated service that is invoked from within the player. This is possible since MPEG-4 allows additional sensors that are not natively supported to be implemented by including an external service, thus keeping the player implementation standard.

At this moment the user can start playing the game. Using MPEG-4 formalism and a standard player on the client answers to the last requirement.

Even still limited for building geo-localization games, the diversity of possible scenarios that can be created is high. At this point the type of game the can be created is just limited by the user imagination. Examples of created games are available online on the authoring tool website specified previously.

4. USING THE M2RGC

In order to demonstrate the usage of the M2RGC, we implemented a game "Tidy City", designed by Michael Straeubig for the TOTEM project[2]. The scenario of the game is following: the player is walking in a certain game area and virtually picking up objects that are marked on the map. When object is picked-up, information for the object (image and description) is displayed on the screen. Then the player should find the object in the real world and "deliver" it at

[2] www.totem-games.org

that location. Points can be achieved in both actions: “pick-up” an object and “deliver” it on the right place. Objects can have different difficulty levels, thus give different amount of points when delivered.

To create this game several components are needed: a map, locations and objects of interest. Afterwards, the behavior of the game needs to be defined and to associate the elements in the game, on the map and in the real world. We are providing a short video together with this paper, showing the described usage of the authoring tool. The entire process is reflected in creation on several types of content, all supported by the tool and listed in 4.2. The process itself is easy and self guided. The most of the time needed to create the game is dedicated to acquisition of images and synthesizing of the description for the objects that will be used in the game, while only several minutes are enough to build the game itself. By using this approach the game creator task becomes simple and interesting. Another advantage is that new objects can be adder or removed easily, while the behavior of the game remains the same, giving a feeling to the game creator of creating a completely new game.

5. CONCLUSION AND PERSPECTIVES

In this paper we presented the first easy-to-use authoring tool for creating mobile mixed reality games. We showed how MPEG-4 BIFS can be used as a representative formalism for such games. The advantages of using a standardized formalism can be seen in the easy generation of such content as well as its straightforward deployment on multiple platforms. This is facilitated by the fact that the content can be created independently from the player. Therefore, in order to support a new platform, only the player should be ported, while the whole content created previously can remain the same. This is very important in the ever-changing world of mobile devices.

Future developments include defining a larger range of games that can be created. Furthermore, in the next version of the authoring tool we will develop second and third level for the game creation tool, dedicated for users with some programming experience. The tool will have different restrictions to game creator depending on his knowledge and desires.

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