

Implementation of Adaptive Multimedia Application Concept in iDTV Environment

Filip Hanzl, Zdenek Mikovec, and Pavel Slavik

Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic
{filip.hanzl,xmikovec,slavik}@fel.cvut.cz

Abstract. This paper describes a model of adaptation of multimedia application. The adaptation is based on user's progress in using a content of the application and a plan that defines long-time usage strategy of the application. The model was applied to education application but it can be used also in other use-cases. This model was designed to be easy to implement and use, and it is an alternative to robust learning models. The implementation of the model is presented on Physical Exercise application.

1 Introduction

Introduction of iDTV brought new HCI challenges coming from new user groups and new interactive environment. Nowadays the iDTV represents hybrid platform substituting television, personal computer and game consoles, and merges them together. From this perspective the iDTV content should be divided into three groups: (i) broadcast (in form of classic television), (ii) applications (similar to PC applications) and (iii) interactive multimedia applications (MA), which are combinations of both. The iDTV also offers several ways how to transfer content: (i) the broadcast brings the same content to all users, (ii) Internet Protocol television (IPTV) contains symmetric communication and it is able to transfer optional content to the user, (iii) a standalone application, independent of the content transfer, runs on user's iDTV device from its own data storage.

We have conducted a research of MAs and control of their content in iDTV environment, already for several years. We aim especially on education content (t-learning applications) [1]. Main problem we faced was an adaptation of the content according to user's progress in usage of MA. We were looking for simple model, which would define particular rules for control of the content. Related models based on personalized learning management system usually aim just on personalization and initial setting of MAs [2].

This work deals with an adaptation of MAs in iDTV environment. We have proposed a model of adaptive MA (AMA) independent of the way the content is transferred. Usage of this model is demonstrated on a Physical Exercise application developed in the framework of Vital Mind project [3].

2 Model of Adaptive Multimedia Application

We propose the model of AMA aimed on control of the content by user's progress during the work with the content. We also propose a formal description of the model. Components we use are partially transferable to SCORM [4] components.

Basic components of the content we are working with are multimedia content elements (MCE) that are similar to SCORM objects SCO. These elements are arranged into plans, which control the sequence of their execution. Plans are similar to SCORM sequencing. Finally we use rules for evaluation of user progress during the work with the content. All the control data are defined in XML files.

2.1 Multimedia Content Element

The multimedia content element has a form of video and is supplemented with an additional data. The additional data are divided according to the direction of an interaction and the synchronization with a video stream.

Synchronous content that contains information for the user is included in the video stream. While the content is being replayed, the synchronous data that are captured from the user as response to the content of the video stream are continuously evaluated. Finally a corresponding feedback is displayed to the user according to the evaluation rules. The feedback should be extended by an interactive questionnaire, which could be used for various purposes (e.g. to specify a reason of the user's failure). Integration of the additional content into the MCE is presented by the scheme in Fig. 1.

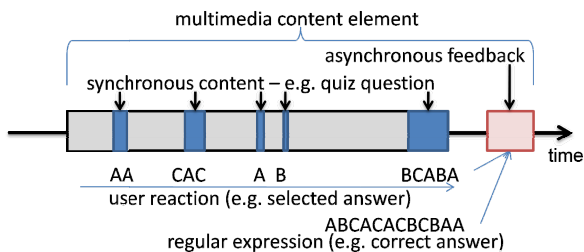


Fig. 1. Scheme of multimedia content element (MCE)

Synchronous content can be understood as a call for user interaction. A reaction to the content is expected in a form of key-press or set of key-presses. The key-presses are converted into characters and stored in captured string. When the playback of the multimedia content element finishes, the captured string is evaluated according to the predefined rules.

2.2 Plans and Rules

As it was mentioned above the MCEs are sorted into a plan. The plan represents the whole course where the multimedia application should take place. The plan is divided

into several sessions, but real passing through the plan depends on the defined rules and their evaluation. Each session is created by one or more MCEs. When user starts the application for the first time, s/he enters the first session in the predefined plan. When the user successfully passes one session, s/he can start next session in the plan. On the other hand, when the user fails, s/he has to repeat current session (see Fig. 2).

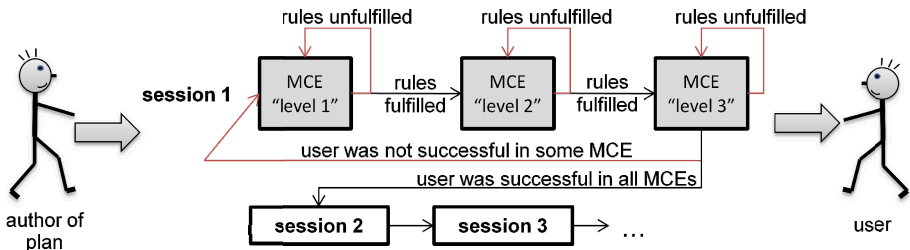


Fig. 2. Scheme of the model of AMA

The rules for evaluation of the synchronous content are formally defined by a regular expression which describes required behavior of the user. The regular expression is compared with string captured from an input device. The result of the comparison is an arithmetic variation defined as number of different characters between the regular expression and the captured string divided by the length of the regular expression. The variation is then compared with predefined tolerance value.

If the variation exceeds the tolerance, the plan is marked as unsuccessful and the user cannot proceed to the next MCE or session. The user has to try passing the MCE again until the variation is not lower than the tolerance. The repetition of one MCE may be annoying to the user. Therefore the tolerance is temporally increased (e.g. by 10%) for each additional trial in order to allow the user to reach other MCEs in the plan. This simplification enables the unsuccessful user to finish the session, but the session is still saved as unfulfilled and the user has to pass it again next time.

3 Implementation - Physical Exercise Application

Physical Exercise (PE) application is an iDTV application designed for elderly users. The application guides the user through series of physical exercises, which are demonstrated to the user in a form of video. The user has to repeat particular movements according to the video. The application uses special prototype of remote control that transfers user’s movements into key-presses, which are captured by the application.

The implementation of the PE application is based on the model described in the previous chapter. It is implemented in Adobe Flash Lite 3.0, thus it can be used on different platforms including various types of iDTV devices. The definition of exercises, related regular expressions and training plan are stored in XML files.

The application starts the session according to the plan and particular exercises are shown. While the user is performing an exercise with the remote control in her/his hand, chars corresponding to particular movements are stored into a string. At the end of each exercise the captured string of movement chars is compared with the regular expression and evaluated. An appropriate feedback is then given to the user.

As all the data are located in XML files and video stream, the PE application can be easily filled with other types of exercises or any other content.

The PE application was tested with users in laboratory usability tests. These tests confirmed usability of the application, but it was not intended to proof the adaptability model. The PE application was also included in a package of applications, which were tested in the long-time test with participation of 54 elderly users. At the end of each of first three sessions participants of the test were asked what they were expecting to do next session. At the first session 18 participants responded that they were expecting similar or more complicated exercises. At the third session already 50% of the participants knew that the following session would contain the same or more complicated exercises according to their results. Although the model of the adaptation was not introduced to the participants they understood it relatively well.

4 Conclusion and Future Work

We have designed a model of AMA. The tool for AMA creation was implemented and used for implementation of the Physical Exercise application for iDTV. It can be also easily modified for other purposes.

In the future we will implement applications for other suitable use-cases based on our model. This can lead to further extensions of our model. These new use-cases can be for example language courses or educational quizzes similar to TV shows.

The other goal of future development of the model is to verify acceptance of the concept of adaptation by the users on different content than physical exercise. New long-time tests should be examined to analyze the users' acceptance of the adaptation provided by our model.

Acknowledgements. Research described in the paper was partially conducted within the framework of the Vital Mind project [3], funded by the European Commission.

References

1. Cmolik, L., Mikovec, Z., Slavik, P., Mannova, B.: Personalized e-learning in interactive digital television environment. In: IADIS Int. Conference WWW/Internet (2007)
2. Rey López, M., Meccawy, M., Brusilovsky, P., Díaz Redondo, R., Fernández Vilas, A., Ashman, H.: Resolving the Problem of Intelligent Learning Content in Learning Management Systems. *International Journal on E-Learning* 73 (2007)
3. Vital Mind Project: Research project number ICT-215387, <http://www.vitalmindproject.eu>
4. Advanced Distributed Learning: SCORM 2004, 4th edn. (2004), <http://www.adlnet.gov/Technologies/scorm/default.aspx>