PERSONAL DATA PROTECTION FOR MEDICAL ASSISTIVE SYSTEM USED BY MOTOR DISABLED PATIENTS BASED ON MPEG-21 SCHEMAS

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Abstract

In this paper is proposed a general model for personal data protection of motor disabled patients who use recently developed medical assistive system for rehabilitation. During the predefined exercises by medical personnel an overall evaluation is done for the degree of completeness of each prescribed movement based on audio-visual and inertial sensor record. All this data needs to be protected from unauthorized access so here a systematic mean is proposed for the purposed based on MPEG-21 schemas for protection of digital resources.

1. INTRODUCTION

In a number of fully or semi-autonomus medical assistive systems specially designed for rehabilitation of people with various disabilities arises the need of introducing a robust approach for the personal data protection of the patients. A recently developed system of the kind [1] posed the same problem. Instead of developing an independent protocol for data storage, processing and transmitting here a more flexible approach is suggested by incorporating the well defined and widely approved MPEG-21 [2-8] schemas for intellectual property protection adapted for the current specific purpose. With a slight change of the existign xml-definitions from the standard it is possible to establish a fully portable framework for personal data protection of the patients.

2. RIGHTS EXPRESSION LANGUAGE (REL)

REL is designed as a machine-interpreted language by which to declare rights and permissions using the definitions from the dictionary with data rights (RDD).

In REL is set flexible, open mechanism to ensure transparent and increased use of multimedia resources. Discussed are ways to access and manage non-commercial redistributable resources that are extremely personal content with the goal of protecting privacy.

REL guarantees and the possibility of interaction of "the end user – to an end user" regardless of the systems and devices. This implies wealth and extensibility when declaring the rights, conditions and obligations; ease and consistency in identification and association of these properties for each resource, as well as flexibility to support multi-business models.

MPEG REL adopts a simple and flexible model for many of its key concepts and elements. MPEG REL Information Modeling for defining the rights consists of four basic elements (Fig. 1). The relationship between them is defined by MPEG REL highlighting permission.

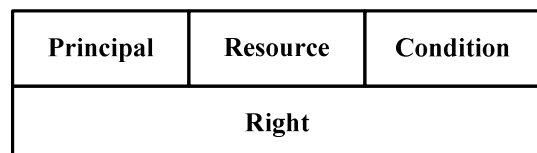| Principal	Resource	Condition
Right		

Figure 1. Information model of REL

Structurally it consists of:

- Primary user (Principal), who provides this permission;
- The right (Right), which defines permission;

- Resources (Resource), to which the law of permission applies;
- condition (Condition), which must be fulfilled before the right can be applied.

Primary user can represent multiple users who are given appropriate rights by permissions. Each primary user represents just one country through its unique content of information by proving his own identity. This type of identification supports the following technologies:

- Main users representing multiple proxies, the identity of each of which must be checked for authenticity;
- Marketing key to mean an individual who possesses the secret key, such as a private key encryption system, working with a pair of keys - public and private;
- Emerging technologies of identification.

The law is a set of actions that allowed the main user to exercise on a resource under certain conditions. MPEG REL defines an element which comprises information about the rights for those that are often used, and for the more specific ones. These are as rights for publication, cancellation and receipt. There are extensions to the MPEG REL to define specific rights such as to be viewed and printed at the printer an e-record.

Resource is the object for which the main user receives certain rights. It may be a product or service. MPEG REL provides a mechanism for packing the information necessary for the identification and use of a single resource or resources that correspond to a certain class, i.e. characterized by similar parameters correspond to the particular business model or technical administration.

The condition determines the period, permissions and obligations in respect of which a right is exercised. Condition is just a time interval within which the right may be exercised. Slightly complicated condition is one in which requires a valid law, provided the main user. Using this mechanism the exercise of a right can become dependent on the exercise of other rights.

MPEG REL defines a separate element which covers the information on the conditions. Extensions to MPEG REL define and conditions suitable for specific use in consumer models as a watermark for example.

The main elements in the data model of the MPEG REL: basic user (principal), right (right), resource (resource) and condition (condition) can match (but not necessarily be equivalent) user (user, including Terminal), right (right), a digital object (Digital Item) and condition (condition) in the terminology of MPEG-21 Part 1.

Since MPEG REL is defined using XML schema recommendation of the W3C (World Wide Web Consortium), its elemental model follows the standard that connects some elements with classes from other elements. Example item permission (grant) is connected to its successor elements: the core consumer law resource and condition.

In the development of medical-based system, the subject of this study, as it's shown below, will use defined in this part of the standard language, namely REL. Here only it's pointed out the most important features and it's emphasized its importance in the design and maintenance of large complex systems for the organization and delivery of multimedia resources according to MPEG-21. The full specification defining specific rules in syntax and semantics, as well as the inevitable exceptions to them are given in [6].

3. RIGHTS DATA DICTIONARY (RDD)

Part 6 of the MPEG-21 is a natural continuation of the previous section 5. RDD includes a set of clear, consistent definitions that make up the base of REL, which integrate without controversy in it, but also to preserve their uniqueness matter. The structure of the dictionary is defined in parallel with the methodology of its creation. The means by which you can create new definitions are also addressed in this part of the standard. In this sense, the term RDD hiding two separate entities – first standard (Part 6) defining the means and rules to create new definitions, the other - the full range of already existing ones, which come into immediate use.

The dictionary is normative in the sense that it defines clearly important for any term (term), represented by separate RDD title (headword), but also recognizes the description of other RDD titles created by other sources and registers them by identical transformations defined in this Part 6 of MPEG-21.

There are four specific mechanism by which the terms defined in RDD in the above template can be presented in REL:

1. REL multimedia rights (multimedia rights) and RDD nudity type (act types) - REL defines a set of XML complex types using a base abstract type parent right (right). These newly types fall in the namespace urn: mpeg: mpeg21: 2002: 01-REL-NS. Any action in respect of multimedia resources in certain contexts may be related to the type of acts within the RDD. For this purpose it is necessary multimedia rights and acts types to be associated with unambiguous links.

2. Additional RDD nudity type represented as REL rights - these are all further implement the acts type than those listed above, which also includes within the namespace.

3. RDD resource type (resource types) as REL resources (resources) - they are obtained using a new generation of complex XML types, which are the heirs of an abstract resource type (resource).

4. RDD context type (context types) as REL conditions (conditions) - they are obtained using a new generation of complex XML types, which are the successors of the abstract type of condition (condition).

In order to synchronize the process of introduction of terms defining the rights whose existence and provision ensures smooth implementation of actions on multimedia products by consumers is developed and a regulatory scheme to support RDD. It is called control (management) model RDD (Fig. 2).
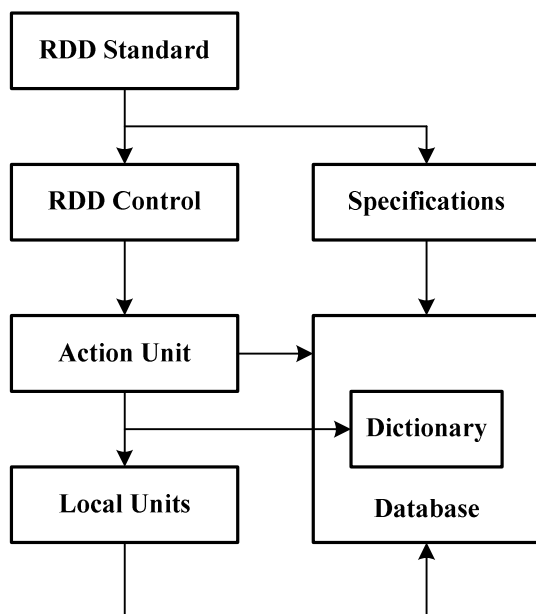

Figure 2. RDD Control Model

On the basis of this model it is created and called RDD system whose components are three:

1. The specifications defined by the standard RDD.

2. Dictionary composed of terms and their attributes, in accordance with the specification.

3. Database - the means by which the dictionary is stored.

This system will help a lot for reliable processing and exchange of information between all stakeholders in the management of rights over multimedia resources.

The process of registering a new term or terms set begins with filing an application to the governing body of the registration authority, which in turn provides samples of the applicant. The idea is for this process to be carried out electronically with the maximum degree of automation against errors of subjective factors. Management unit in turn appoint a new registration procedure for assigning identifier for the proposed new term that is included in the database. This is done in accordance with all established at RDD standard rules, which are the most senior in a hierarchical relationship in the system (Fig. 2). Executive departments, along with local ones, some of which may be set up temporarily when necessary, are assigned structured sequence and duration tasks related to the verification of the compatibility of the newly proposed terms. Another is their duty continuous maintenance of the database with already accepted terms and providing access to it for the purpose of authorized bodies or persons.

This completes the applicability of part 6 of the MPEG-21. The complete specification of RDD standard is given in [7], a full XML schemas for basic types-parents, referred to the above model - in [6].

4. DIGITAL ITEM ADAPTATION

Part 7 of the MPEG-21 is designed to describe a set of tools which enable the adaptation of digital objects to specific conditions of their use by consumers. For a description of these funds are used exclusively normative XML descriptions, descriptions of the semantics of each component of the given vehicle, as well as purely informative examples of their use.

The purpose of the item Terminals and Networks, described in ISO/IEC 21000-1 as part of a 7-element model of the interaction between users is to

enable transparent access to the latest multimedia resources and protect them from any procedures for installation and setup of network components and terminals. Achieving this goal is possible with the introduction of DIA. Key elements of this model are the module to adapt the resource (resource adaptation engine), the module to adapt the description (description adaptation engine), integrated into a single module to adapt the digital objects. The result of processing is adapted to digital object (adapted digital item) while this treatment been used, DIA (DIA Tools), are the basic subject to standardization.

We note that both modules of Fig. 3 themselves are not subject to standardization within the meaning of Part 7 of MPEG-21.
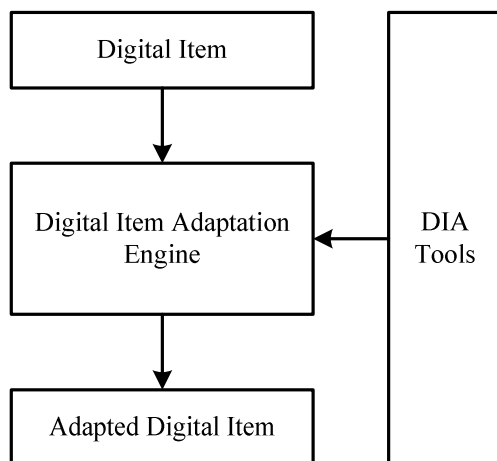

Figure 3. Digital Item Adaptation

These descriptions and mechanisms that are format (in terms of file or other structured records) in independent processing resource within the digital object can be regarded as an external set of tools (DIA Tools) and that they are standardized here. Specific application on specific platform (operating system), communication protocols, etc. are not subject to consideration.

DIA resources are divided mainly into three groups. The division is mainly by functional status.

The first group is a means to describe the environment of use (Usage Environment Description Tools), which include customized features, capacity of terminals, network characteristics and conditions of the surrounding environment in the broadest sense. These characteristics directly affect the ways of transmission, storage and processing of multimedia resources, mainly from actions which are under their physical media.

The second group is the means of adapting the resources of digital objects (Digital Item Resource Adaptation Tools). These agents directly affect the structure and management of resources of digital objects. When using bit-stream syntax description of these tools one can control the transmission speed of the transport flow. This method is particularly suitable for the exchange of resources, stored in the network nodes (nodes abutment), which load can vary widely depending on the needs of the consumers. Another important tool, found a place in this group is what controls the quality of the service(s) on a network terminal (Terminal and Network QoS (Quality of Service)). Third means of this group provides the adaptability of metadata (Metadata Adaptability) filtering and scaling official information flows based on simplified XML frameworks (templates) for a description.

The third and final group is the means of adapting the reporting of digital objects. They demonstrate the overall adaptation of the structure completed on digital objects, not just the resources that are part of them. One means of providing mobility session, expressed in the possibility of redirecting the flow of information from one terminal to another without impairing quality of reception and keeping the overall structure of the otherwise complex digital objects. Elections within a digital object can be changed by using the tool to configure preferences for the declaration of the digital object (DID Configuration Preferences) and then, depending on the intentions and preferences (preferences) to the user. And with reports of a profile adaptation of digital objects (DIA Description Messages) providing conditions for registration, transfer, update and delete DIA descriptions.

The fundamental unit of distribution and supply in terms of MPEG-21 is a digital object. While individual parts of this standard deal with different aspects of this fundamental unit, the connection between all of them forms a complete multimedia framework. It rationalization and realization of this relationship is crucial to reach a workable system for MPEG-21.

Part 2 of ISO / IEC 21000 (DID) provides a wrapper of all other parts of this standard. One of the input parameters for the module performing the adaptation of digital objects is meaningful digital object (Content Digital Item - CDI), which is a special case of a digital object, which necessarily incorporates a few resources, respectively. With DII this object is identified by content (ISO / IEC 21000-3). Possible,

but not necessarily it contains elements defined in other parts of the standard - 4, 5 or 6 in any combination, but to perform DIA, it must be carrier of the required funds set according to Fig. 4.

Digital Item Adaptation Tools	Usage Environment Description Tools
	Digital Item Resource Adaptation Tools
	Digital Item Declaration Adaptation Tools

Figure 4. Digital Item Adaptation Tools Organization

This is not necessarily because the model to perform DIA is provided and the possibility that these funds are part of contextual digital object (Context Digital Item - XDI). This type of objects does not carry any resources, but they are carriers of multimedia metadata framework themselves. Thus XDI is a catalyst in the process of adaptation as a second input to the module, carrying out adaptation. They are also subject to identification (DII) before being used. Thus a possibility is provided to adapt and to receive digital object as an output from the DIA with a changed DID identifiers, IPMP / REL elements, DIA elements, and resources. The complete specification of Part 7 of MPEG-21 is given in [8].

5. CONCLUSION

In this paper a new methodical approach is suggested for personal data protection based on the existing and widely spread MPEG-21 schemas for intellectual property rights management extended to medical information obtained during the process of patient rehabilitation. It is addressed towards a currently developed medical assistive system for motor disabled users whose results from undertaking prescribed exercises must be protected from unauthorized access. It is considered that the proposed methodology is applicable to wider range of medical systems yet to be amended.

6. ACKNOWLEDGMENTS

References

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