An Interoperable and Inclusive User Modelling concept for Simulation and Adaptation

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Abstract. This paper presents a concept of an interoperable user model that takes a more inclusive approach than previous research. It is an initiative of the EU VUMS cluster of projects which aims to simulate user interaction and adapt interfaces across a wide variety of digital and non-digital platforms for both able bodied and disabled users. We have already been successful to define an application and platform-independent user model exchange format and the importing of any user profile across all projects.

1   Introduction

User models can be considered as explicit representations of the properties of an individual user including user's needs, preferences as well as physical, cognitive and behavioural characteristics. Due to the wide range of applications, it is often difficult to have a common format or even definition of user models. The lack of a common definition also makes different user models - even if developed for the same purpose - incompatible to each other. It does not only reduce the portability of user models but also restricts new models to leverage benefit from earlier research on similar field.

This paper presents a concept of an interoperable user model and a set of prototype applications to demonstrate its interoperability between the different projects of the VUMS cluster. VUMS stands for "Virtual User Modelling and Simulation Standardisation". The cluster is formed by four projects (GUIDE, MyUI, VERITAS and VICON) funded by the European Commission and is partially based on the results of the VAALID (`http://www.vaalid-project.org/`) project. The concept of user modeling has been explored in many different fields like Ergonomics, Psychology, Pedagogy and Computer Science. However, it still lacks a holistic approach. Psychological models often need a lot of parameter tuning reducing their use by non-experts [2] while ergonomic models often miss to model cognition [4]. Carmagnola and colleagues [3] presented an excellent literature survey on web based user models but completely missed out user models in Human Computer Interaction [5].

2 VUMS Cluster Approach

The VUMS cluster proposes a holistic approach towards designing interoperable user models for both simulation and UI adaptation purposes over a wide range of applications including automobile, digital television, computers, washing machines, mobile phone interfaces and so on considering users with different range of abilities.

The VUMS cluster took the following approach, in order to develop an interoperable user model:

1. Definition of a common vocabulary to avoid confusion among terms like user model, user profile, simulation, adaptation, etc.
2. Description of the terms in accordance to the existing standards [6].
3. Definition of a set of relevant user characteristics covering physical, perceptual, cognitive and motor abilities of a wide range of different users.
4. Definition of a VUMS exchange format to store these characteristics in a machine-readable form.
5. Development of a set of converters, able to transform a user profile following the VUMS exchange format into each project's specific user model and vice versa (Figure 1 and 2).
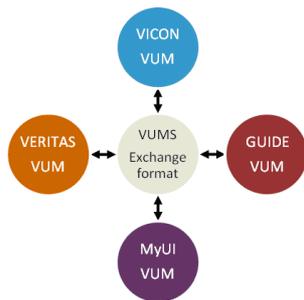
Figure 1: VUMS Exchange Format
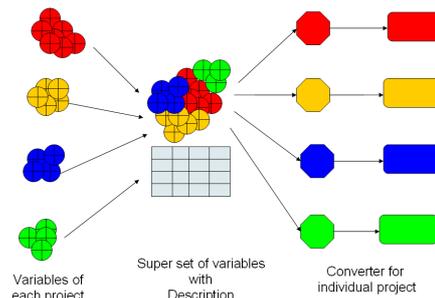
Figure 2: VUMS Converters

The proposed VUMS exchange format includes a large set of variables describing various human characteristics (motor, visual, hearing, cognitive)[1,2]. This set of parameters is a superset of the parameters used in each of the VUMS projects and it is defined through a set of descriptors, which are categorized following a taxonomy and are expressed in both human and machine readable form. If missing parameter values appear during transformations between the projects' profiles, they are filled either by default values or estimated by internal tools.

Use case. The following example illustrates how the VUMS exchange format enables the use of a project-specific user profile by another project. The VERITAS project investigates automobile interface design and stores anthropomorphic details of users

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[1] http://www.veritas-project.eu/vums/wp-content/uploads/2010/07/White-Paper.pdf

[2] https://docs.google.com/spreadsheet/ccc?key=0AnAwpf4jk8LSdDd3TEJWLUtmN290YzVfT
kNvcHYyMUE&authkey=CPOO65oE

including range of motions of different joints in VERITAS user models. On the other hand, the GUIDE project develops adaptable interfaces for digital TV interfaces and it uses the active range of motion of wrist to predict movement time for simulating interaction [2]. So, it reads the values of pronation and supination from a VERITAS profile stored in VUMS exchange format and uses them to derive active range of motion of wrist. Similar case studies include other variables (visual, hearing, etc.) and projects like VICON and MyUI. Currently, all VUMS projects can import profiles from the other projects. Thus, the simulation of interaction in different application domains (automobile, mobile phone, digital TV, etc.) is achieved for any user profile.

3 Conclusion

We described the efforts of the VUMS cluster, constituted by the EU-projects GUIDE, MyUI, VICON and VERITAS, towards a common user model that can be used for different purposes (e.g. simulation, UI adaptation, etc.). The proposed VUMS exchange format includes a large set of physical and cognitive user characteristics, sensory attributes, habits and preferences and enables the development of application-independent user models to be used across a wide variety of digital and non-digital devices and systems. Preliminary results show that this approach covers satisfactorily the need for interoperability between different projects. However, some gaps have been identified during some transformations from a project-specific user model to a VUMS profile needing further investigation.

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ABSTRACT

This paper presents a concept of an interoperable user model that takes a more inclusive approach than previous research. It is an initiative of the EU VUMS cluster of projects which aims to simulate user interaction and adapt interfaces across a wide variety of digital and non-digital platforms for both able bodied and disabled users. We have already been successful to define an application and platform-independent user model exchange format and the importing of any user profile across all projects.

INTRODUCTION

User models can be considered as explicit representations of the properties of an individual user including user's needs, preferences as well as physical, cognitive and behavioural characteristics. Due to the wide range of applications, it is often difficult to have a common format or even definition of user models. The lack of a common definition also makes different user models even developed for same purpose to be incompatible to each other. It does not only reduce portability of user models but also restrict new models to leverage benefit from earlier research on similar field.

The present paper presents a concept of an interoperable user model and a set of prototype applications to demonstrate its interoperability between the different projects of the VUMS cluster. VUMS stands for "Virtual User Modelling and Simulation Standardisation". The cluster is formed by four projects (GUIDE, MyUI, VERITAS and VICON) funded by the European Commission and is partially based on the results of the VAALID (http://www.vaalid-project.org/) project.

VUMS Exchange Format

The VUMS exchange format is used for the definition of the proposed common user model. It includes a large set of variables describing various human characteristics (motor, visual, hearing, cognitive)[1,2].

[1]http://www.veritas-project.eu/vums#wp-content/uploads/2010/03/White-paper.pdf
[2]https://docs.google.com/spreadsheet/ccc?key=0AnAmpfqklsL5dG3TEJjW1UtMN290YzVffNvcHYhMUE&usrkey=CP0O6S6E
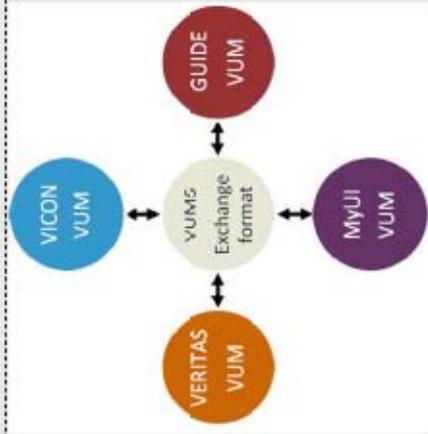
Figure 1. VUMS Exchange Format

User Model Converters

Within the context of each project of the VUMS Cluster, a converter able to transform a user profile following the VUMS exchange format into each project's specific user model and vice versa has been developed. If missing parameter values appear during transformations between the projects' profiles, they are filled either by default values or estimated by internal tools.
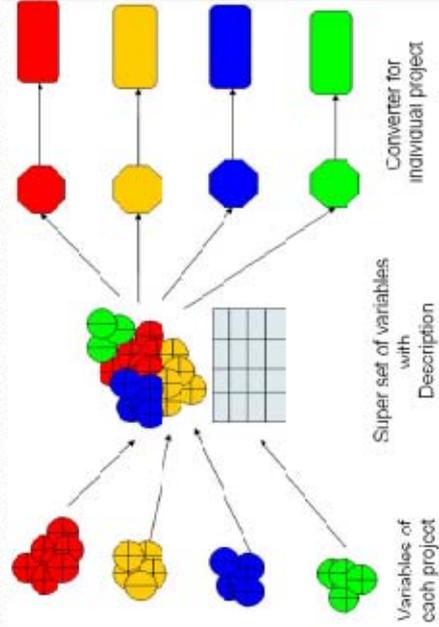
Figure 2 VUMS Converters

USE CASES

The following example illustrates how the VUMS exchange format enables the use of a project-specific user model by another project. The VERITAS project investigates automobile interface design and stores anthropomorphic details of users including range of motions of different joints in VERITAS user models. On the other hand, the GUIDE project develops adaptable interfaces for digital TV interfaces and uses the active range of motion of wrist to predict movement time for simulating interaction. So, it reads the values of pronation and supination from a VERITAS profile stored in VUMS exchange format and uses them to derive active range of motion of wrist.

Similar case studies may also include other variables (visual, hearing, etc.) and projects like VICON and MyUI. Currently, all VUMS projects can import profiles from one project to other, and, thus, the simulation of interaction in different application domains (automobile, mobile phone, digital TV, adaptive interfaces) is achieved for any user profile.

CONCLUSIONS

We described the efforts of the VUMS cluster, constituted by the EU-funded projects GUIDE, MyUI, VICON and VERITAS, towards the development of a common user model that could be used for different purposes (e.g. simulation, UI adaptation, etc.).

The proposed VUMS exchange format enables the development of application independent user models to be used across a wide variety of digital and non-digital devices and systems.

Preliminary results showed that that this approach covers satisfactorily the need for interoperability between different projects. However, some gaps have been identified during some transformations from a project-specific user model to a VUMS profile needing further investigation.

VUMS Cluster web site

http://www.veritas-project.eu/vums/