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VICON

Virtual User Concept for Inclusive Design of Consumer Products and User Interfaces

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Summary

The present document is part of Task 1.4 –Functional and System Requirements, of the Work Package 1 – Scientific and Technical Foundation. The objective of this deliverable is to define the functional and non-functional requirements of the VICON Virtual Lab, which shall be mandatory for defining the specification of the system in WP3. The deliverable consists of a description of the Virtual User Concept of VICON which includes the Volere Template Requirement Structure (Robertson & Robertson, 2010).



1 Description of Virtual User Concept

1.1 Concept Approach

The core of the Virtual User Model approach in VICON is to capture key interaction characteristics of users with consumer products in formal representations and make these available in a database to drive usage simulations. All aspects which adequately describe the user of the consumer product and his situation, thus have a mediate or an immediate impact upon the features of a user interface, are contained in the database. These include attributes and specific characteristics of the user groups (shown as “Virtual User” in figure 2). Apart from the aspects directly linked to the user, the VUM incorporates a description of the interaction components which constitute the user interface of the envisaged consumer product (shown as “Components” in figure 2), including specific attributes that describe partial devices like a keyboard or a screen as a Visual Interaction Device. In conclusion, the user configuration model, task model, environment model, and component model are the core elements which describe the virtual user model.

From the view of the product developer there has to be a possibility to configure the Virtual User Model with predefined elements (see also figure 1, “User Model Configuration” and “Device Type Configuration”). Besides this, the product developer should be able to specify a functional model, which includes the executable interactions of the end user of the consumer product. These interactions do not resemble the tasks of the user, but the functional processes which are required to operate and control the product. Functional processes are for instance “Choosing a program of a washing machine” or “Execution of a phone Call with a cell phone” (see also figure 1, “Scenario and Task Configuration”). The configuration of the virtual user model and the specification of the functional model are



finally adequate constraints in order to obtain an appropriate recommendation for a user interface component. In the same pre-design configuration phase the product designer should possess the possibility to model the task of the underlying scenario, whereas the task does not only impact the choice of user interface component, but will also be considered in the evaluation phase.

The second phase, the design phase, has the aim of creating virtual mock-ups (virtual prototypes) of the user interface components in a CAD application. The recommendations of the configuration phase are integrated through API of the framework and are interlinked with predefined design pattern templates and are displayed in the CAD 3D Model Design View. These templates support the designer in virtually constructing the user interface components. After finalization of the virtual components, these flow into the third phase - the evaluation phase.

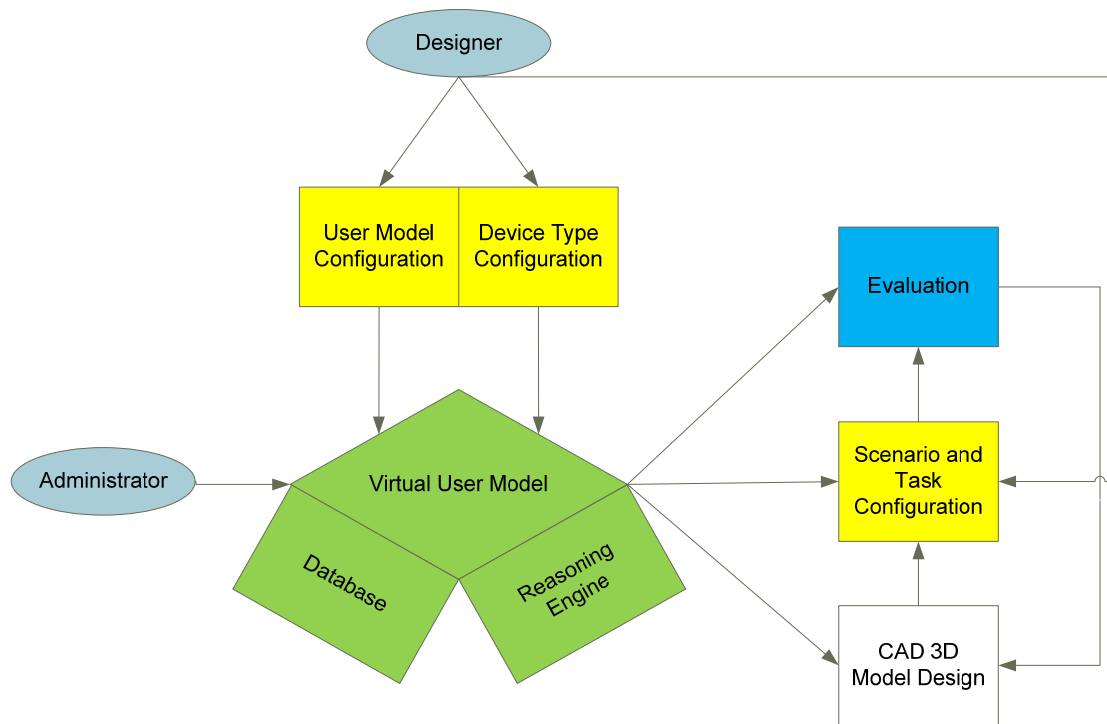


Figure 1 Abstract time-dependent functional concept structure of VICON

In the evaluation phase the product designer can test the 3D CAD Model he built inside a scenario, based on the Virtual User Model data, to get an assessment of usability for impaired users.

Figure 1 shows the evaluation and the design phases connected to each other. After the CAD User gets results from the evaluation she or he can try to get better results by changing aspects of the device model. This stage continues until the CAD User decides that the results



are good enough, resulting in an iterative and eventually converging back and forth between device adaptations and evaluations.

The role of the Administrator shown in figure 1 is the configuration of partial devices and definition of rules and relations between the parts of the Virtual User Model. Rules and relations define specific constraints for which the Reasoning Engine can calculate recommendations based on given parameters. For instance, if the model of the virtual user template Molly defines that she is visually but not acoustically impaired, it is better to use a speaker as an interaction device than a display.

The role of the Designer describes the time-dependent VICON approach as an end-consumer. The figure shows also different VICON-specific partial structures, shown as different colors:

- Yellow: Configuration parts that describe the CAD-Designer defined Virtual User, Device Type, Scenario and Tasks.
- Green: Virtual User Model, Database and Reasoning Engine, that are using the CAD-Designer defined Configurations to generate the Virtual User, Environment and Scenario.
- Blue: Evaluation where the information from the Virtual User Model is used to build a time-dependent virtual environment.
- White: CAD 3D Model Design, where VICON gives recommendations

For further details about this structure see D2.1 and D2.2.



1.2 The Scope of VICON

1.2.1 Product Boundary

Our approach of a Virtual User Concept includes various scenarios and use cases. The use cases are divided with respect to the role of the user, which uses the VICON system. In our concept we especially separate the user roles of the Designer and the Administrator, whose main task is the system maintenance and the adaptation of the VICON Databases to the specific company.

1.2.2 Product Use Case Table

PUC No	PUC Name	Actor/s	Input & Output
1	User configures device to design (washing machine or mobile phone)	Product Designer	Product type (in)
2	User defines Virtual User	Product Designer	Virtual User Specifications (in)
3	User designs device and gets live recommendations	Product Designer	Used Partial Devices (in) Recommendations (out)
4	User defines Virtual Environment	Product Designer	Virtual Environment (in)
5	User defines Tasks and Functions for Virtual	Product Designer	Tasks and Functions (in)



	User		
6	VICON tests designed device in an evaluation	Product Designer, VICON Reasoner, Virtual Environment	Designed Product
7	VICON generates Results and Recommendations for Designer	VICON VUM, Product, Virtual Environment	Evaluation (in) Results & Recommendations (out)

1.2.3 Individual Product Use Cases

The Individual Product Use Cases in the VICON scenario are divided into two perspectives.

1.2.3.1 Designer

- Configuration of a user model
- Configuration of an environment and scenario
- Definition of scenario functions and tasks
- Design of CAD model and live recommendations for partial devices
- Evaluation of CAD model through defined VICON Scenario

1.2.3.2 Administrator

- Configuration and extension of device database to used devices in company



- Definition of rules and relations between components and virtual users
- Maintenance of database

1.3 Functional Diagram Parts

The functional diagram is a class diagram showing the entities and their relationships that are described in the use cases. The whole system is divided into the 5 subgroups Virtual User Model, CAD, Scenario, Reasoner and Evaluation, which are connected through interfaces.

1.3.1 Virtual User Model

The following diagram shows an abstract Virtual User Model from our approach. It consists of the three main parts “Rules and Relations”, “Virtual User” and “Components”. For further details, see also D2.1 and D2.2. This part of the Virtual User Model, based on their functional information, is dynamic (time-dependent). Another part with the environment model and task model is described in section 1.3.3 and more specifically in D2.1 and D2.2. The VUM Interface, described in figure 2 represents an interface used for all sections of VICON to link with the Virtual User Model data.

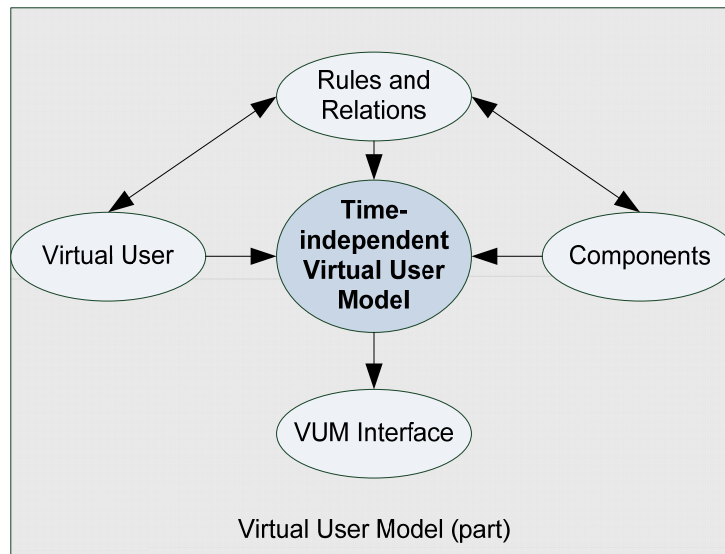


Figure 2 Abstract Virtual User Model for functional requirements without scenario models

1.3.2 CAD

This part of the system consists of the User Configuration, which type of device the designer would like to design. In VICON we concentrate on the device types “mobile phones” and “washing machines”.

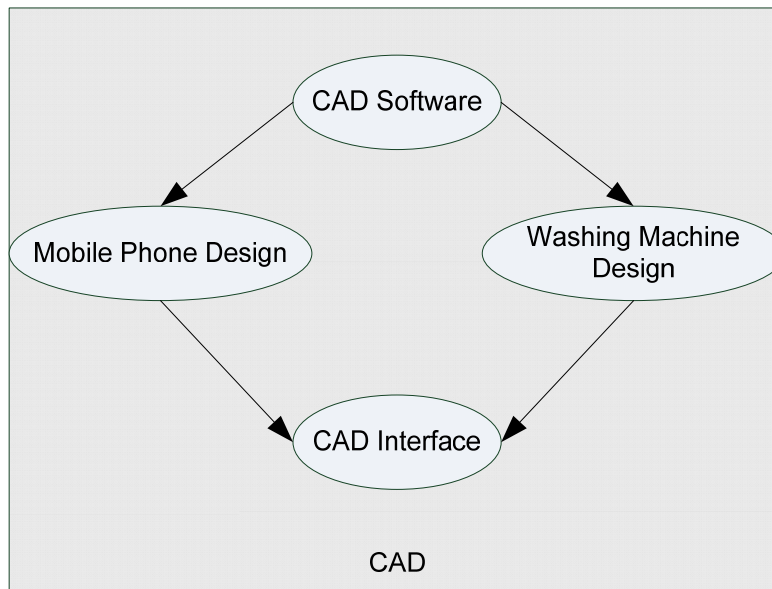


Figure 3 CAD Interface with User selection for device types

1.3.3 Scenario

The Scenario part is mainly an evaluation-related part. It is the main interface with the Designer, where she/he can configure his scenario, tasks and environment. In this structure the dynamic (time-dependent) part of the Virtual User Model with the environment and task model is used to create a scenario for the evaluation.

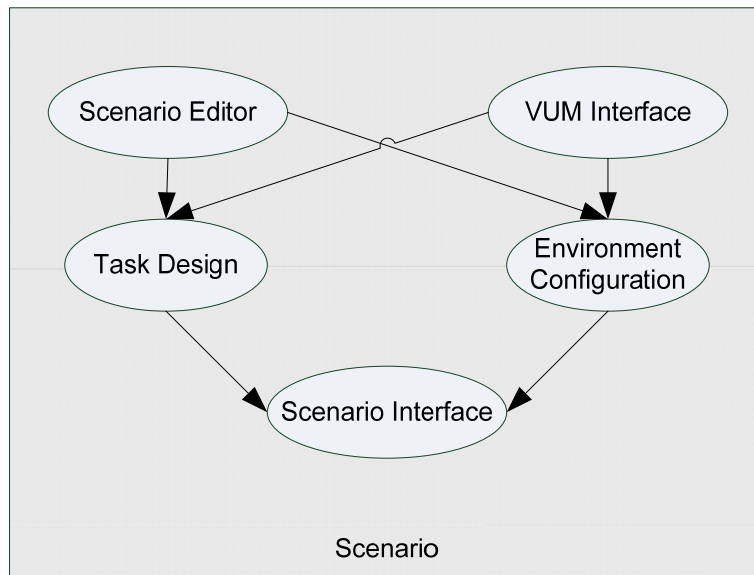


Figure 4 Scenario Configuration for Evaluation through graphical user interface

1.3.4 Reasoner

The Reasoner is a self-contained subsystem. It consists of all algorithms to choose and build recommendations for the evaluation to choose appropriate partial devices for the CAD Model. Thus the functional requirement has no internal structure and therefore a separate figure is not necessary.

1.3.5 Evaluation

The last part is the evaluation part, where the user can evaluate his created CAD Model in the defined scenario.

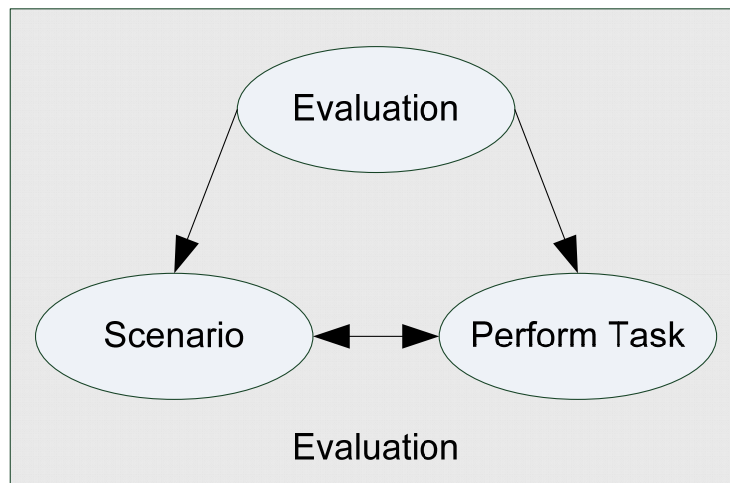


Figure 5 Evaluation with scenario and task execution

1.4 Complete Functional Diagram

The complete functional diagram is made from the parts from 1.2, and should give an overview of the VICON Concept from the functional side, which is relevant for the definition of functional requirements. It only shows an abstraction of the complete system architecture, which is needed for the functionality of VICON.

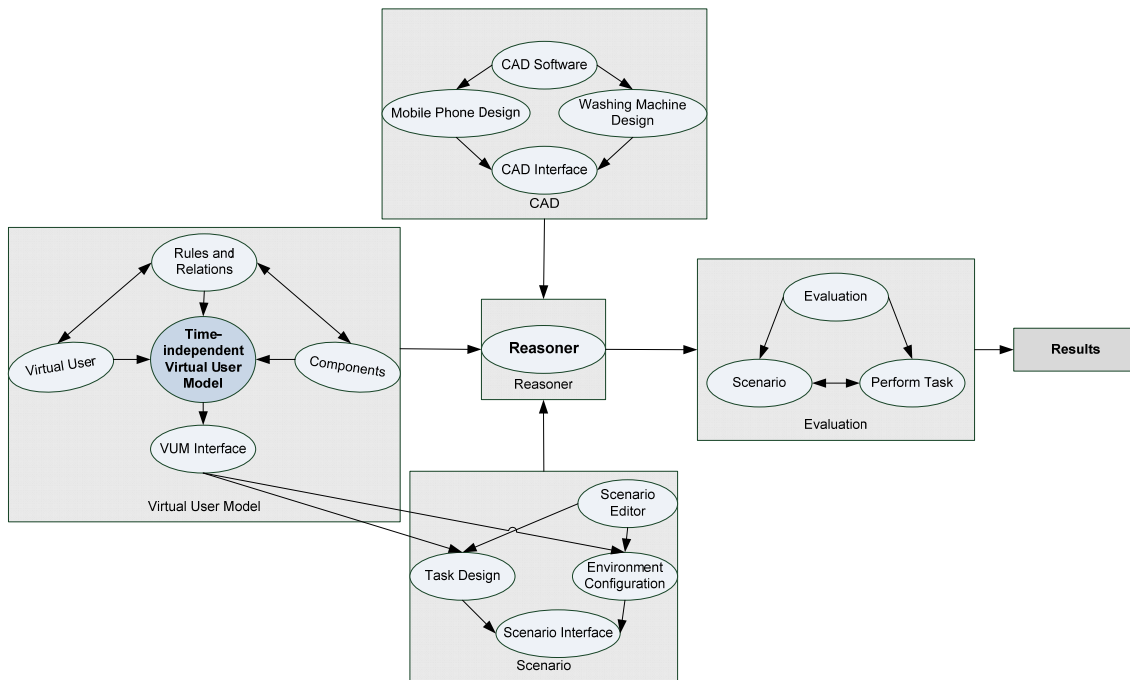


Figure 6 Complete abstract functional requirement diagram for VICON

2 Functional Requirements

The functional requirements are based on the use cases (1.1) and the roles Administrator and Designer. This chapter represents the functionality of the complete VICON system based on the Volere Template. Related to our approach, we used not the complete shell of Volere to define requirements, but only detail information about the fit criterion and the priority.



To create a comprehensive overview of currently used tools and frameworks, a multi-vector approach was carried out. Personal interviews with representatives of the industry, media research, an email survey, and a product development survey in the form of a questionnaire were conducted.

Based on the roles from chapter 1.1, the VICON system must provide at least three different interfaces. The first one is the Designer Configuration Interface where the designer configures all relevant data for the scenario and the environment. The second is used for Evaluation of the designed product. The third is an interface for the administrator to carry out general maintenance and configuration of the database.

2.1 Tables of Functional Requirements

2.1.1 Role Designer

Custom ID	Name	Description	Fit Criterion	Priority
0000 01	Create Device database	The features of required devices are created and stored in a database	Database contains device models	Mandatory
0000 02	Create Virtual User database	The characteristics of the virtual user should be created and stored in a	Database successfully created	Mandatory

		database		
0000 03	Create Environment database	The features and measurements of required contexts should be created and stored in a database	Database successfully created	Mandatory
1000 01	Device Type Configuration	User must be able to select, which type of device she / he designs	Device types accepted by Virtual User Model	Mandatory
1000 02	Virtual User Configuration	User must be able to select among defined classes of virtual users	Virtual User Definition accepted	Mandatory
1000 03	Environment Configuration	User must be able to define an environment	Environment configuration tests in evaluation	Mandatory

1000 04	Scenario Configuration	User must be able to define functions for scenario	Scenario accepted configurations	Mandatory
1000 05	Device Recommendations	VICON generates automatically a set of partial devices the designer can use to design his CAD Model	Empirical studies for acceptance of recommendations	Mandatory
1000 06	Scenario Generation	VICON generates a scenario from given informations and functions	Database contains scenario description	Mandatory
1000 07	Evaluation	VICON evaluates the given CAD Model in the generated scenario	Scenario is executed	Mandatory
1000 08	Results	As the main results of the VICON Evaluation	Empirical studies with complete	Mandatory



		the system returns whether the CAD Model effectively can be used by impaired people	VICON system	
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2.1.2 Role Administrator

Custom ID	Name	Description	Fit Criterion	Priority
1000 09	Database Configuration	Administrator must be able to configure the database for the used components	Administration of database components is possible	Mandatory
1000 10	Rules and Relations	Administrator must be able to define and change rules and relations between the User Model, Environment, Scenario and Devices	Evaluation tests	Mandatory
1000 11	Validation	Administrator can validate the sets of rules and relations	Administrator can perform a validation check	Mandatory



1000 12	Maintenance	Database maintenance	Administrator can perform a maintenance check	Mandatory
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3 Non-Functional Requirements

3.1 Look and Feel Requirements

This section contains requirements related to product experience, and defines features which concern the VICON system appearance.

Custom ID	Name	Description	Fit Criterion	Priority
2000 01	Corporate Branding	The VICON system shall comply with corporate branding standards	Corporate Branding accepted by system	Optional
2000 02	Language Support	User can define a used language for the VICON System	User is able to select languages	Optional

3.1.1 Appearance Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2100 01	Colour Definition	The user can set the colours that are used inside the system	User is able to control colours	Optional
2100 02	Definition of Digital Human	User is able to configure a digital human from templates	Empirical tests	Mandatory
2100 03	Customizing of GUI	User should be able to configure buttons, scrollbars, etc. of the GUI	User is able to configure the GUI	Optional

3.1.2 Style Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2200 01	Style of Digital Human	The User can define and change specific features of the Virtual User	Evaluation phase tests	Mandatory
2200 02	Customizing of Digital Human Configuration	User is able to configure Panel Button Positions of	Empirical tests	Optional



	Panel	the GUI etc.		
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4 Usability and Humanity Requirements

4.1 Ease of Use Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2300 01	Efficiency of use of the VICON System in the CAD System	The benefits of the VICON system must outweigh any overhead it might create for using the CAD system	CAD Program performance is not strongly affected by VICON	Mandatory
2300 02	Error rates	It must not be crucial that the user commit very few, or no, errors	Empirical studies	Mandatory

4.2 Personalization and Internationalization Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2400 01	Profiling system	The User can create profiles for VICON	Profiles accepted by VICON	Optional
2400 02	Language support	The User can	Languages	Optional



	in the complete VICON System	change the GUI language in VICON	accepted	
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4.3 Learning Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2500 01	Training Period with VICON	The VICON system shall include help files to support the training period of the User	Empirical studies	Mandatory

4.4 Understandability and Politeness Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2600 01	Symbol and Words Usage	The system shall use symbols and words that are naturally understandable by the user community	Empirical studies	Mandatory

5 Performance Requirements

5.1 Speed and Latency Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2700 01	Generation of Results	The generation of results from the system must be acceptable for the usability of the system	Implementation Tests	Mandatory

5.2 Safety-Critical Requirements

Custom ID	Name	Description	Fit Criterion	Priority
2800 01	Change of informations	Just the Administrator should be able to change the VICON Database directly	Implementation Tests	Mandatory



6 Conclusions

This document shows the functional and system requirements of the complete VICON System. It should be noted that the product development departments of the VICON industrial partners DORO and ARCELIK provided their input to this document. In this sense it is ensured that all requirements are generally in line with the specific requirements raised by the VICON industrial partners.

The requirements include parts of the Volere Template Requirement Structure (Robertson & Robertson, 2010), especially the fit criterion, that defines the momentum the requirement is solved. From the viewpoint of the Implementation phase of Vicon, this document presents frames for mandatory and optional requirements of the software.

Finally these requirements form the basis for developing the specification of the VICON framework within WP3.



7 References

Robertson, J., & Robertson, S. (2010). *Volere Requirements Specification Template*.