Presentation Scheme for Mixed Reality Interfaces

Luis Romero[1,2] lmcr@di.fct.unl.pt
Jorge Santiago[1] jms@di.fct.unl.pt
Nuno Correia[1] nmc@di.fct.unl.pt

[1] Interactive Multimedia Group
New University of Lisbon
Portugal

[2] School of Technology and Management
Viana do Castelo Polytechnic Institute
Portugal

ABSTRACT
This paper describes a presentation scheme to be applied in augmented reality interfaces and is integrated in a generic hypermedia model that is used as a framework for building context aware and mixed reality applications. The hypermedia model specifies a base structure for the relation between spaces, either real or virtual, and supports contextual mechanisms. The presentation scheme handles different media elements, allows dynamic features necessary in augmented interfaces, and abstracts several relevant navigation concepts, including link awareness. An authoring application to associate information with spaces is being implemented, using the hypermedia model as the base framework, including the presentation scheme.

INTRODUCTION
The introduction of new devices and media types, the integration of the physical space in the application design, and the adoption of augmented reality as the main interface, is the main concern of the presented work. There is the need for hypermedia models to include a way to correlate the real world and the information space taking into account the presentation issues. Augmented reality [1] is an excellent form of interface when interacting with real environments as enables to present information in the real world.

Having this objective in mind, the work reported here focus on methodologies to address the problem of defining environmental spaces and correlate those with the information through an augmented reality interface [3]. The base model, implemented as a set of C++ classes to be used by programmers, is summarized and the role of the adopted presentation scheme is emphasized in the overall relation scheme. A short text is dedicated to an authoring tool being developed using the model, finally ending with conclusions.

BASE INFORMATION MODEL
To represent the information an object-oriented framework based on the Dexter Hypertext Reference Model [2] is used. It consists of three layers: Runtime, Storage, and Within-Component. The Storage layer represents the database organization associated with the hypermedia system. The basic object class provided is the Component which includes three main subclasses; (1) Atomic represents a basic data object, (2) Link establishes relations between components, and (3) Composite provides a hierarchical structuring mechanism, by including other components on it. The Link includes a list of specifiers, each including a component and anchor identifiers, and a direction. Anchors provide a way to reference data portions. In the proposed model the information data is mainly represented by Atomic components. It has the subclasses Text, Image, Audio, Video, 3D, and Map. The first four classes hold the basic data types. The 3D class contains 3D descriptions of objects and the Map class represents spaces, either as 2D or 3D models. It is impossible to specify every existing data type, so the class Application embraces the representation of any kind of data type. Access portals are defined in the model by Entity components that contain the relevant links to access information. The Entity component establishes the relation between the real/virtual spaces, with the virtual or real entities within it, and the information system.

The model represents spaces of any kind using Map components. Spaces are assumed to have levels (space sub-representation) and themes (contextual representation). To represent both, a Link subclass Space defines the relations by using the directional characteristics of links. Children/parent directionality denotes space sub-representation. Bi-directionality denotes level equality or themes with different representations. Space links are directly associated with Map components, where the geographical data is represented.

SESSION MODEL
The Runtime layer is responsible for handling component instantiation, and resolve links at run-time. The following sections focus on the Presentation Scheme. In a mixed reality environment based on an augmented reality interface, the presentation scheme is a key to accomplish a variety of possible interfaces.

Presentation scheme
Many different approaches are adopted in presenting media and navigation to users. From static arrangements of data with simple navigational aids to a more dynamic and fluid interface based on film aesthetics [4], the possibilities are innumerable. An augmented reality environment extends those concepts by introducing the real world as a user interface element. This yields the need for the interface to adapt its content and opportunities to the user's real experience, bringing new considerations into the interface aesthetic dynamics.

The aim is to allow dynamic characteristics, common in augmented reality interfaces, in the interface construction and presentation and allow a structured mechanism in its conception. In the hypermedia system, the tree-structured interfaces are specified by Composite components, which act as content containers. The content is represented by Atomic components, as described in the Information Model. The contents are linked to its parent containers, and the link itself defines the spatial behavior of the content within the Composite. This kind of linking is accomplished with the Content component, a Link subclass. It references the media data and it specifies the spatial behavior within the container. The Presentation Specification, in both Composite and Content components, establishes the timed region to be used relative respectively to its parent and its origin. Three main sets of attributes define the Presentation Specification for any component: spatial transformation, temporal pattern, and animation. The Presentation Specification spatial transformation can also be specified with absolute, relative, or dynamic values. The first two allow (or not) the position values to change according to the container (e.g. display device) dimensions. The later is dependent of runtime values that specify the container position and used to follow a detected entity within the interface display.

Link Awareness

The navigational link has special requirements to represent concepts of link awareness, following, prediction, and opportunity [4]. Awareness involves the link representation in such a way that the user notices its existence. The following property indicates if the link is about to be followed, e.g., using animation or audio cues. Prediction gives users an idea to what the links stands for. Opportunity defines temporal behavior of the link and temporal existence of the same link. These features are represented with exactly the same mechanisms as the ones used for presenting content, within containers.

To handle these requirements, navigational links are represented in the hypermedia model by a special Link subclass, the Navigation component. Its Presentation Specification only defines the regions susceptible of navigational selections. These regions have the same behaviors of the content regions but are not visually represented. The link representation is obtained by linking its content, using Content links, to the Navigation link itself, with exactly the same possibilities as in the presentation scheme. Since a link can have different representations to be associated with the link, it uses anchor IDs to represent possible link states.

AUTHORING TOOL

An authoring application is being developed to easily define information correlated with spaces. Since the information is dependent of detected space entities in space, the interface contents directly depend of access portals that relate entities with information. For such reason the application is focused on spaces and the entities within those spaces.

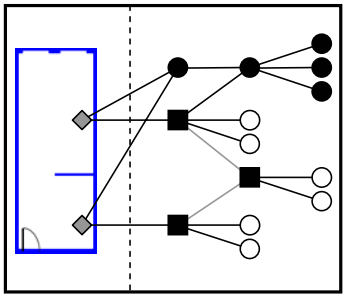

Figure 1. - Space dependent hypermedia graph

As illustrated in figure 1, in the authoring tool the hypermedia graph emerges from a space through Entity components (grey shapes) that define the presence of interests. Attached to these are interfaces (squares) that specify the content (white circles) associated with each entity. The space representation is also present (black circles) not only to define the several space relations but as a content itself.

CONCLUSION

A model to support data representation and navigation in physical and virtual worlds is presented. It includes all the location and space management along with presentation scheme and contextual mechanisms that are more relevant when dealing with mixed environments, including the real world. Key components of the model include support for augmented reality interfaces enabling to specify dynamic data behavior within an augmented interface seamless integrated with the hypermedia model. Presently the model is been used as a framework for an authoring toolkit centered on space relations and used to associate contextual information, and also in a mixed reality game and storytelling environment where users interact with real and virtual environments.

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