Visual Hypermedia Authoring

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Abstract

This work proposes a visual grammar-based approach to support web designers during the analysis and the design phases of complex hypermedia structures. The hypermedia is defined through a formal visual language at two abstraction levels: the hypermedia graph outer and inner structures. The model makes it possible to verify the correctness of hypermedia structures and to perform structural analysis for the description and the evaluation of their complexity. A Visual Environment for Hypermedia Structures (VEHS) is also presented.

1. Introduction

The development of large hypermedia applications for the Web is not an easy job. In fact, the main goal of such applications is to allow the user to follow the association of the human mind. To this aim, hypermedia applications generally handle hundreds of nodes, interact with many different programs or run on distributed systems. Consequently, they should be developed taking into account aspects like navigation design [5]. Presently, hypermedia applications are often directly implemented by using ad hoc techniques, and, as a result, the hypermedia structure evolves from small to large as a "spaghetti like" structure. To avoid these problems, several models and methodologies for the design of hypermedia applications have been proposed in literature, focusing on specific issues, [3][4][7].

In our approach, we consider the modeling of hypermedia structure. Essentially a hypermedia can be treated as consisting of discrete entities such as nodes, links, anchors which obey a series of syntactic and semantic rules describing their interrelationships. For this reason, it is possible to define a hypermedia through a formal visual language, by writing an appropriate visual grammar. The advantage deriving from the use of the visual language technology is principally in the automatic generation of a visual environment for processing hypermedia structures [1]. The environment can be specified at a high level to enable hypermedia designers to perform operations such as integrity checks on the nodes and links, and/or structure complexity measurements.

2. A Visual Environment for modeling Hypermedia Structure

Each hypermedia system can be represented by considering two abstraction levels: the outer structure and the inner structure. The *outer structure* identifies the hypermedia graph defined in terms of nodes and links and the *inner structure* is the structure internal to each hypermedia node; it is defined in terms of *anchors*.

To improve the information access and the hypermedia navigability, in the creation of a hypermedia, few, but important, constraints should be respected. The constraints can be divided, according to [6], in three categories:

- ***Hard*** constraints expressing required properties of the structure. If a hard constraint is not respected, an *error* has to be generated. Examples of hard constraints include constraints on the hypermedia seen as a graph and consisting of nodes, links, anchors, specific types of data, etc.
- ***Soft*** constraints expressing desired, but not required properties of the documents.
  A *warning* is generated if a soft constraint is not respected.
  Examples of soft constraints are the absence of dangling links, loops, or the absence of not-connected portions of hypermedia.
- ***Optional*** constraints expressing optional properties of the documents.
  The use of metrics, the minimum number of links of a single node or the maximum lengths of paths from root to leaf are examples of optional constraints.

In our grammar-based approach, we implement hard constraints and part of soft constraints in the basic grammar, and the remaining soft constraints together with optional constraints through semantic rules to be applied to each grammar production.

Based on this, the hypermedia outer and inner structures have been modeled by an eXtended Positional Grammar (XPG for short) [2]. We have implemented the visual language for XPG in a Visual Environment for Hypermedia Structures (VEHS). The environment allows the user to concentrate on

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the logical structure and its navigational issues. Due to this, it can be employed both during the *hypermedia design phase* and/or for the *structural analysis of existing hypermedia* or web structures.

A prototype of VEHS has been implemented by using the grammar-based tool Visual Language Compiler-Compiler (VLCC) [1], for the automatic generation of visual environment. In general, VLCC takes as input the syntax and semantics of a visual language and the graphical aspect of its components and produces an integrated environment composed by a graphical editor and a compiler for the implemented language.
Figure 1 shows the implemented VEHS after the analysis of a complete hypermedia structure. The author draws the structure by using the symbols shown on a palette, then the environment processes the structure and provides a result window signaling that the structure does not violate any hard constraint.
Moreover, warning messages are provided for alerting that some soft constraints have not been respected:

- the hypermedia is not totally connected, there exists 2 connected sub-hypermedia;
- node *n1* has 1 dangling link;
- node *n2* has 1 loop.

Optional information on the hypermedia structure is provided, such as the list of the nodes belonging to each sub-hypermedia and the list of all the links. The optional information allows us to identify optional constraints, such as the maximum number of the outcoming links of a node, etc.

3. References

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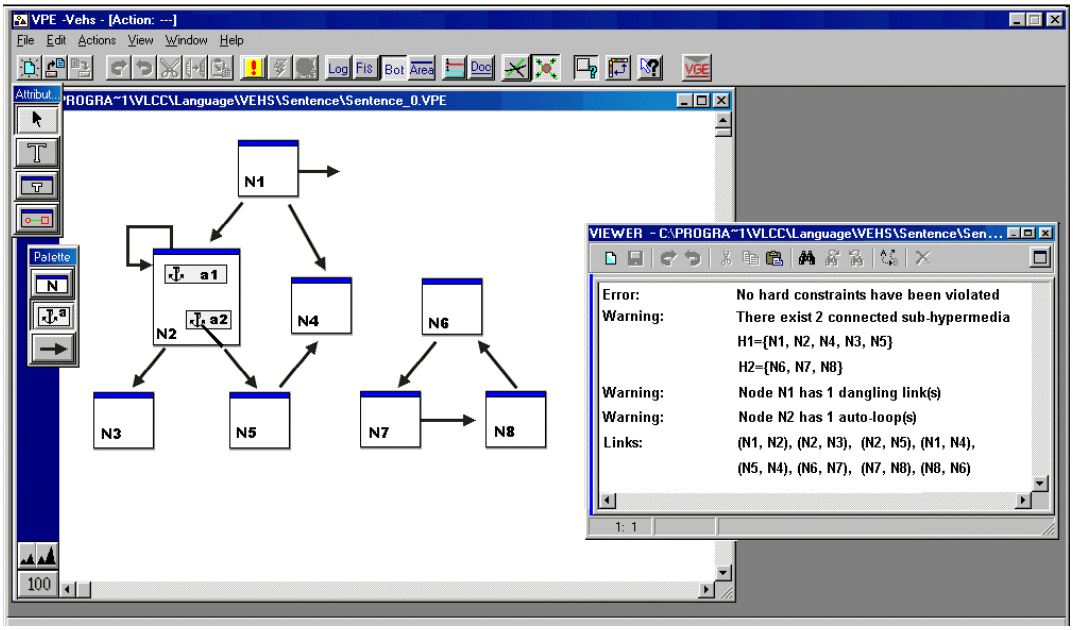

Figure 1. A screendump of the VEHS environmen