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# Considerations on the Development of a Refactoring-Based Navigation Model for On-line Transaction Systems

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## Abstract

The purpose of our present research was to diminish the users' dissatisfaction related to navigational limitations of on-line stores. The outcome may well be used also by the firms which implement transactions and commercial web applications. Our case study was carried out on the platform of a virtual store, for whose navigation model we used a class diagram, via UWE (UML-based Web Engineering), which needed to be modified for the navigation sustainability. There were two main sequences in the model development. In the first instance, we chose the classes which could be accessed directly and, in this fashion, we would acquire the class navigation diagram. The second instance consisted in diagram's extension with access structures and system menu, thus resulting a navigation structure diagram used for easily gaining each point of the application. At this point, we utilized refactoring in an attempt to offer a quality model for both developers and users.

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## 1. Introduction

Designing a proper navigation of the web application is an important activity. The correct preparation of a navigation model has two important advantages: on the one hand, it supports the developers to build a high-

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quality Web application; on the other hand, it assists the users, since it contains the basic traversal capabilities. Even in some cases when an application has a medium-depth hierarchy, it may be possible for the model to become very complex, due to the links. Noticeably, the links added to the model would facilitate the user-interactions, but as a consequence, diagrams can become very complicated.

In actual fact, by creating the navigation model, the structure of the online application is generated, where the designer decides which classes to include. In addition, exploring navigation paths is very important, because it is the only way to reach the system's desired functionality.

Initially, refactoring was introduced in object oriented applications. In that case refactoring meant a source code's syntactic transformation that improved its internal structure. Refactoring was typically done in small steps, so not to divert from the original purpose of the system. However, by using this method the model may undergo major changes in order to obtain a high-quality system.

The need to use refactoring comes from design flaws. This course may have unconstructive effects on the project, if not acknowledged near the beginning. Both system developers and users can suffer from this case.

In the circumstances of web applications, refactoring is used in both navigation and presentation models. Essentially, refactoring a navigation model means modifying the topology of the navigation. Henceforward each page is preserved, nevertheless with a quality improvement in navigation.

The present paper is structured as follows: in Section 2 we discuss several related works in the field; Section 3 contains the proposed methodology; in Section 4 we illustrate the refactoring of the navigation model of an online trading system; Section 5 provides some concluding remarks and further research plans.

## 2. Related Works

Refactoring can be defined as a technique in which a code or model is undergoing small and systematic changes, without changing its semantics. It was also extended to the design level by Moha et al., 2008 and this is how the model refactoring term was created, Van Kempen et al., 2005. In the case of web applications, UWE is regularly used for model refactoring. The UWE (UML based Web Engineering) is a suitable approach, Frydensberg, 2008, for the development of web applications with the aim to automatically generate a web system. UWE modeling recommendation was that both the navigation structure and the presentation model to be carried out using UML class diagrams, Frydensberg, 2008, Zhuang and Junwei, 2009, Comes et al 2006.

Kempen et al., 2005, presented a refactoring illustration derived from SAAT (Software Architecture Analysis Tool). It allowed calculating various metrics for UML models, values which were then used to identify design deficiencies. The UML class diagrams embodied the models, whose behavior was represented using state-charts. Once the metrics results implied the use of refactoring, it was done with no alteration to the model behavior.

Another refactoring model was projected by Zhang et al., 2005, based on C-SAW (Constraint-Specification Aspect Weaver) – an engine that transformed models. The authors offered a refactoring browser, which allowed custom models' processing in various fields. The proposed transformation was not anchored in meta-models and not an MDA approach.

Garrido et al., 2007, investigated means to increase a Web application's external characteristics and usability, while preserving the functionality of the system. For navigation refactoring purposes, the navigation class diagram was used – an UML class diagram where classes represented navigation nodes, associations represented navigation links, and indexes were a particular node defined to enable one-to-many navigation.

Cabot and Gómez, 2008, presented a catalogue for refactoring, which aimed to improve existing navigation models. In their research, refactoring was interpreted as graph transformations. Each rule included necessary conditions for the navigation model behavior to be maintained during the refactoring.

In the following sections of this paper, we put forward refactoring within a navigation structure model.

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