MoVi: Models Visualization for Mastering Complexity in Model Driven Engineering

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ABSTRACT

Model Driven Engineering (MDE) is a good candidate for scaling up complex systems thanks to the principle of separation of concerns. In HCI, models describe the UI at different levels of abstraction and are matched to each other with a variety of relationships. However, MDE puts HCI designers in front of a new problem which is mastering the complexity of many and possibly huge models. Parallel to this evolution, "Big Data" is an important research trend. It brings new perspectives to deal with "Big Models". The paper presents MoVi (Model Visualization), an interactive environment that bridges the gap between these two trends by processing models as data.

CCS Concepts

•**Human-centered computing** → **Visualization theory, concepts and paradigms;** *Visualization design and evaluation methods;*

Keywords

Model Exploration, Complex Model, Model Relationship, Interactive Visualization, HCI Engineering

1. PROBLEM STATEMENT

Model Driven Engineering (MDE) comes with the risk of model proliferation (models, meta-models, and transformation). For instance in Human Computer Interaction (HCI), Cameleon [4] introduces four design layers with abstraction relationships. This complexity brings new challenges such as the global understanding of model eco-systems.

Some works allow to master model complexity by tackling only one complexity factor which is levels of abstraction to support understanding the whole picture of engineering UIs like IdealXML [7], Mega-UI [9], Model voyager and Quill [5]. They present systems to navigate inside models so that to support the design of new User Interface (UIs). But, none of them fully considers all model perspectives (model, meta-model, transformation) that help designers to understand the whole picture of design.

One solution to handle model complexity to design a visualization tool for supporting model exploration [1]. There are visualization tools that focus on the complex model in different levels of abstraction like CodeCrawler [6] and "Explen" [2]. They have specific interactive features for improving models understanding. However, none of them fully supports the mantra [8] and its main concepts in information visualization like overview, zoom and filter.

2. CONTRIBUTION

We present MoVi (Model Visualization) a visualization tool as a proof-of-concept that supports model exploration by applying interactive visualization technique, the seeking mantra. Basically, we elicit each factor of models complexity like many models by applying "big data" research trend while considering models as data. The implementation uses data driven document (D3) library [3] which provides sufficient feature to implement interactive visualization tool while considering seeking mantra principle. Model is represented as nodes (fig.1-1) with different colours identifying model types. Model relationships are presented as coloured and distanced node's edges. Colour represents the type of relationship, and distance expresses the similarity between models (fig.1-2). The seeking mantra consists of some main functions :

- Overview : provides global context to understand dataset.
- Zoom and Filter : select and focus only on the interesting part by reducing the complexity of data representation and ease further data organisation.
- Details on demand : enables information appearance only when it is needed.
- View Relationships : displays relationships between visualisation data items.
- History : provides feature to comeback to the previous action.
- Extract : extracts important information for dataset.

MoVi provides selection (fig.1-a), details on demand (fig.1-3) and geometric zoom features as well as filtering. There are two main filter types : a) generic filters that allow designer

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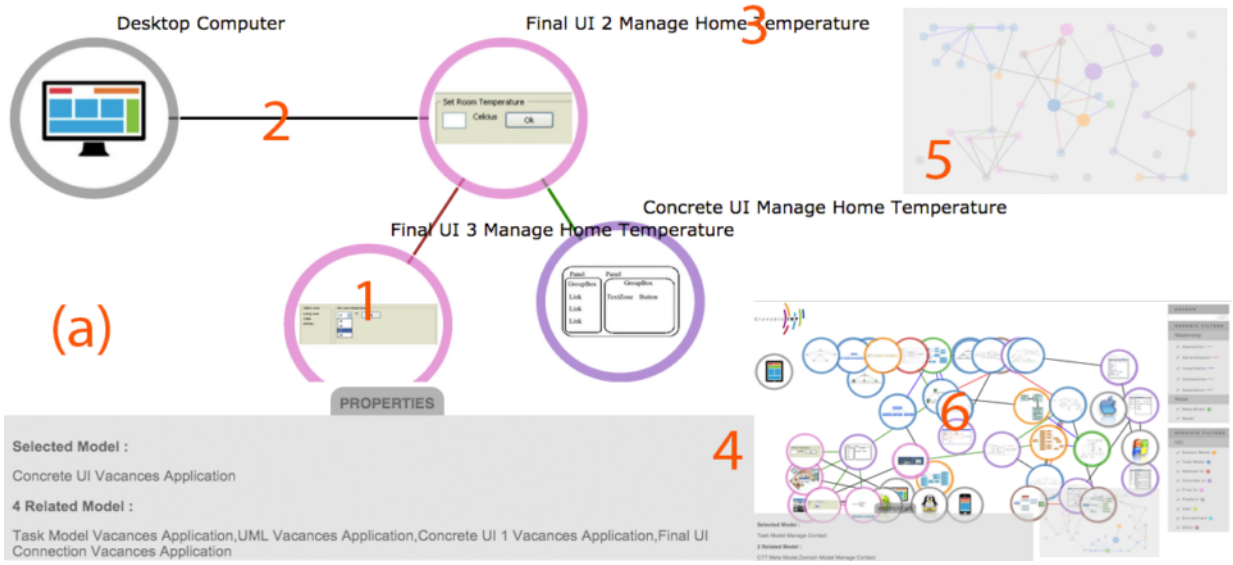

Figure 1: Main page, selection, overview, properties, zoom and details on demand of MoVi features

to filter sub-model based on their relationship (i.e. abstraction, generalisation, composition, instantiation, and association), applicable to both model and metamodel levels, and b) domain-dependent filters (e.g. domain, task model, Abstract UI, Concrete UI, Final UI in HCI).

MoVi gives holistic perspective about models and their relationships to improve model understanding. Additional features like overview to give selection support feature (fig.1-5) and view model properties (fig.1-4) provide detailed model information.

Interactive visualization work consists of 3 subcategories: model collection, data pre-processing, and visualization generation. Model collection is an initial activity to collect the models. Pre-processing aims to format raw data and make models compatible to the next step. It consists of registering model properties, grouping model, and generating JSON (JavaScript Object Notation) format. Group model could be done based on some attributes like model type, relationship, and name.

3. PERSPECTIVES

In the near future, we plan to evaluate MoVi with two kinds of users. Firstly, students learning engineering HCI. The question will be whether MoVi helps them to quicker and better understand the purpose and added value of each model, for example a user task model. Secondly, we would like to address developers in companies and measure to which extent MoVi fosters models reuse.

Then we think about incorporating algorithms from data mining and machine learning for models clustering. It would provide more possibility to group models depending on different categories (functionality, UIs design, model pattern). We expect that users get more knowledge and possible reuse of existing models.

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