A novel Dialog Model for the Design of Multimodal User Interfaces

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Abstract. Variation in different mobile devices with different capabilities and interaction modalities as well as changing user context in nomadic applications, poses huge challenges to the design of user interfaces. To avoid multiple designs for each device or modality, it is almost a must to employ a model-based approach. In this short paper, we present a new dialog model for multimodal interaction together with an advanced control model, which can either be used for direct modeling by an interface designer or in conjunction with higher level models.

1 Introduction and Related Work

Most natural human computer interaction can be achieved by providing the right user interface for the right situation, which also implies selecting an adequate device together with one or several interaction modalities. For this approach, any available input or output device with their respective modalities can be used, which requires a framework to synchronize the interaction as, e.g., presented with W3Cs Multimodal Interaction Framework [1].
These environments can be considered to be highly dynamical with the consequence that just providing platform specific UIs is not sufficient to support all possible kinds of devices and modalities. Therefore, we propose a model based approach to develop UIs that can be provided and adapted on the fly.
As we have identified the necessity to work with UI modeling (see also. [2]), we present MIPIM (Multimodal Interface Presentation and Interaction Model), a new dialog model for the design of multimodal User Interfaces. MIPIM concerns lower levels in contrast to high level approaches as task modeling, e.g. given in [2]. Mainly covered are UI specification and control modeling that allow easy modifications of the UIs during the development cycles and support automated UI adaptations.

2 Dialog Model

Our dialog model provides three components for interaction, dialog flow, and presentation. Since our model aims for multimodality, user interaction is received by

the *multimodal interaction* component. This component accepts input in different modalities and triggers the behavior resolver, which in turn starts generating the resulting UI that will be presented by the *multimodal interface presentation* component for the activated modalities. The dialog flow specification plays a central part. On a first glance it resembles the model, UIML [3] is based on, with a separation between structure and style and the specification of the dialog behavior. However, the specification of the dialog behavior takes a different approach and is based on DSN concepts [4].
DSN allows bundling several local states of a UI and performing a multi state transition through the definition of variables and events together with rules that map events to a new set of states in one pass.

The second important property of this new dialog model is the support of generic widgets that are modality agnostic by providing most basic operations, as described in [5], along with a presentation of the architecture and an according XML-based modeling language. The *multimodal presentation* component is used to map the generic widgets to widgets in a specific modality, while the interaction component does a reverse mapping of these widgets and by that allowing the use of virtually any device or modality for interaction.

3 Conclusion and Future Work

We have presented the MIPIM dialog model, which provides the theoretical background of the framework we presented in [5]. At the moment, we have built a prototype implementation for mobile phones, which demonstrates the efficiency in which our dialog model works on limited devices. In near future, we explore further how to establish real multi device interaction. The foundation is already laid in the control model. Furthermore we plan to integrate our work in larger environments with respective mappings.

References

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Discussion

[Remi Bastide] I wonder if there is a significant difference in expressiveness between DSN and UML Statecharts.

> [Robbie Schaefer] Statecharts are very powerful and can express many things that DSN cannot. But DSN is more convenient to use.

[Michael Harrison] DSN appear to be an enconding of StateCharts.

[Remi Bastide] Statecharts avoid the combinatorial explosion of finite state machines.

[Robbie Schaefer] I will have to examine that.