Using Semantic Descriptions for Adaptive Mobile Games UIs

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ABSTRACT

Mobile devices became powerful recently and wireless Internet access is becoming standard. One important class of networked, mobile applications are location based games, making extensive use of device sensors to adapt their application logic and user interface to the numerous, spontaneous and fast changing contexts. To simplify the developers' task of designing adaptable user interfaces, we propose the use of semantic user interface description. By going beyond form-based applications, we argue that the approach comes especially at hand when used in the context of modular reconfigurable mobile games: The interfaces fusion can simplify the generation of complex adaptable game UIs and form an integral aspect of a mobile game development kit.

General Terms

Design, Languages

Categories and Subject Descriptors

H.5.2 [**User Interfaces**]: Graphical user interfaces; C.5.3 [**Microcomputers**]: Portable devices

Keywords

Semantic Driven UI Adaptation, Location Based Games

1. INTRODUCTION

In classical computer and console games, the "game reality" is completely virtual and the player perceives himself as a part of this virtual world. Location based games are different. They interweave the physical reality with the virtual game world and create a mixed reality. In our research we learned that this fact has some important implications for UI design, leading to three adaptation challenges, which we propose to cope with by using semantically described UIs:

1. Adaptation to different handset capabilities, which even can change at runtime.[1]
2. Adaptation to sensor-triggered dynamic context changes during the game.
3. Adaptation of the game to the players' experiences and favors by modifying the game's rules and components.

[1] E. g. when a user plugs in a headset or mutes the speaker.

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2. THE USER'S DEVICE

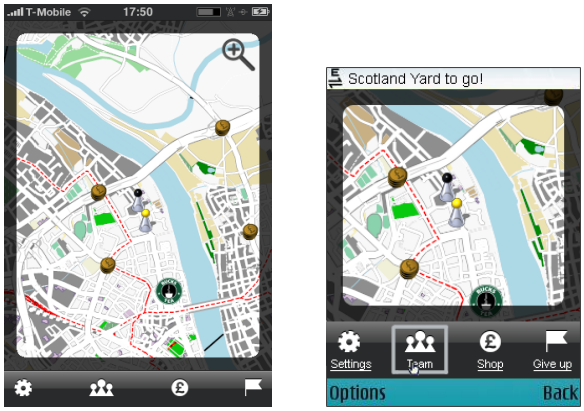
Semantic user interface descriptions (cf. [3]) abstract from the different requirements of mobile devices: the developer focuses on the input and output requirements of the application, while an application-independent rendering framework manages the UI adaptation in function of the use context. Thus, the developer defines *what* should be displayed, and not *how*, which simplifies the application by factoring out many of the adaptation algorithms.

Until now, most prototypical applications for semantic driven UI rendering focus on form based applications (e. g. [5, 4, 2]). We propose to extend this technique so that it supports even the design of interfaces for location based games. We demonstrate the declarative description of a user interface with the example of the main screen of our location adaptive game *Scotland Yard to go!* (see Figure 1(a)).

In the sketched situation the user currently plays with one team-mate, some location based elements are placed around him. The user can interact with the game using sensor input (GPS) or by selecting an explicit action. If we concentrate on the main parts of the given interface view, we can identify the following semantic interaction elements (using the LAIM UI description model [2]):

- A *group* of different location based outputs (whereas each of these location based output elements might be visualized using a map view). These output show the *location of the player herself*, the *location of other players* (team-mates), the *location of special game elements* and *location based partner information*.
- A *group* containing four individual elements each triggering a specific action.
- A (non-visible) *input* transmitting GPS data from the client to the application.

Based on this general description, the game UI could be adapted to other handsets requiring different implementations, as sketched in figure 1(b). Also devices with multiple screens could be supported (e. g. a Nintendo DS), as well as devices which only support text messaging.



(a) (b)

Figure 1: A typical screen of *Scotland Yard to go!*, rendered for an iPhone OS based device (a) and a Symbian device (b).

3. THE USER'S SITUATION

Some of the dynamic context changes triggered by sensors (GPS, time, ...) require a game logic based adaptation, but others just require a UI adaptation, which can be handled (since the semantic of the UI does not change) independently from the underlying game application by a UI framework. Examples for such independent adaptations are:

- When running, buttons on a touch screen are harder to locate and tiny elements are more difficult to notice on the screen. This could be compensated by rendering important action elements bigger while less prioritized elements are faded out.
- Using an ambient light sensor the user interface could be switched to a "night vision" mode which is optimized for visibility in the dark.
- Some devices feature compass sensors which could be used to rotate a map correspondingly to the player's orientation.

4. THE USER'S CREATIVITY

Mobile location based games mainly consist of recurrent building blocks like *localization*, *visualization of position*, *active zones* etc. Many games can be build up by combining these building blocks, assembled by concrete game rules. Providing the user the possibility to recombine and reconfigure these building blocks and their fitting would finally lead to some sort of a mobile game construction kit. Each visual building block of this construction kit framework would have certain input and and output requirements. While each of the building blocks' UIs could be visualized independently, only when merged reasonably together, they form a coherent game UI.

In [3], we proposed UI fusion to support task oriented work with concurrent applications on the go. We can apply this technique here and fuse the separate building blocks' UI elements together to form a common game user interface.

Using UI fusion in a game construction kit has several advantages: Semantic interface descriptions can be part of the kit's API, so that the developers do not need not to cope with the specifics of handsets but can concentrate on functionality. The framework seems to be a natural place to implement the *Context Aware Interface Decorator* and the *Semantic Interface Layout Engine* of [3]. Additionally, the complexity of these framework elements is lower in the game kit's context than it is for office applications, and the selection of elements to combine can be set explicitly.

5. RELATED WORK

Model based UI design for classical and mobile applications has been proposed for almost a decade [7]. As well, UI composition based on semantic or model based descriptions has been under research [9, 6, 3]. Nevertheless, these works mainly focused on form based interfaces. The location based multimedia and gaming framework Mediascape [8] proposes the use of dedicated clients on the devices, as well as the prototype of [1]. The game framework Ex Machina[2] focuses on the game network and logic infrastructure without providing a dedicated API for user interaction.

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