

Integrating Mobile Design Patterns within a User Interface Development Environment

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ABSTRACT

One of the main factors behind the rapid development and wide adoption of modern mobile devices is surely the enormous amount of third party applications available for the various mobile platforms. Nevertheless, due to the unique characteristics of the mobile world, designing usable user interfaces for such applications is still a challenging task. Design patterns were conceived to deal with design complexity providing well-recognized and reusable solutions. However, one of the main difficulties arising when design patterns are used by less experienced users, is the choice of the appropriate patterns for a specific problem. To support novice developers in that choice, we propose MIDE, a tool that devises patterns in the form of ready to use application templates and interface snippets.

Author Keywords

Design Patterns; Mobile User Interfaces; Rapid Prototyping.

ACM Classification Keywords

H.5.2 User Interfaces (D.2.2, H.1.2, I.3.6)

General Terms

Human Factors; Design.

INTRODUCTION

Over the last few years, the growing popularity of mobile devices such as smartphones or tablets has certainly revolutionized our lifestyle changing the way we communicate and access information. One of the key factors for the success of these devices is represented by the wide availability of third-party applications that allow users to perform diverse tasks. In addition, an increasing number of non-professional developers are grappling with the development of mobile applications, exploiting free or low cost development tools. However, those tools do not consider peculiarities of mobile devices that should be

carefully taken into account during the application design and development, to offer a satisfying user experience. Among such characteristics we can mention the poor computing power, the different types of interaction modalities, the different level of support offered by current mobile platforms during the development of a specific feature and, above all, the small size of the screen. Those factors have a fundamental impact on the proper design of what is recognized as the most important component of a mobile application, the user interface. In this paper we present a tool that supports developers during the design of a mobile user interface providing them with ready to use templates and code snippets. Each template is the result of the adoption of currently well-accepted mobile design patterns. The tool can be used either for the rapid prototyping of pattern based user interfaces or as a development support tool thanks to its capability to generate executable code.

The paper is structured as follows. We first briefly introduce and discuss some of the major issues related to the development of usable mobile user interfaces. We describe benefits and drawbacks of the use of patterns as a possible means to manage design complexity. Then, we present the Mobile Interface Development Environment (MIDE) and finally draw some conclusions.

MOBILE USER INTERFACES DESIGN CHALLENGES

Despite their apparent simplicity when compared with traditional complex desktop interfaces, designing mobile user interfaces is often a non-trivial task. In fact, the univocal characteristics of mobile devices entail a series of constraints that are of the utmost importance in order to provide a satisfying user experience. Among such issues we can mention:

- The reduced screen size of such devices, which causes a lack of room for displaying data. Squeezing data to fit the display often results in the loss of relevant information, especially if the meaning of the displayed data depends also on their spatial components [6,11]. Designers are therefore forced to carefully select what to show at a given time. Moreover, considering that the display is not only used to visualize information but is also usually the primary source for input, the

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PID-MAD 2013, Aug 27 2013, Munich, Germany.
(In Conjunction with MobileHCI '13, Aug 27-30 2013, Munich, Germany.)

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right tradeoff should be reached between data visualization and data input areas.

- An excessive hardware and software fragmentation within the various mobile platforms that leads developers to implement radically different user interfaces depending on the potential mobile platform on which the application will be executed. This problem is increased also by the fact that the various mobile platforms, such as Google Android, Apple iOS or Microsoft Windows Phone, have their own conventions and guidelines, for the development of mobile applications in general and for the development of the user interface in particular [15,16,17]. These differences are also accentuated by the coexistence of different releases of the same mobile platform, each with its own guidelines. In addition, the heterogeneity of the graphical resolutions supported by the various platforms represents a further difficulty. A direct consequence of these issues is often evident during the “porting” operation, i.e. when an application designed for a particular platform, such as Apple iOS, is offered also on another platform with the original user interface and without taking into account the specific design guidelines of the new platform.
- Lack of expertise, formal training and well recognized standards for development and testing of mobile interfaces. These issues are more likely to happen when mobile applications are developed by small teams or single developers. In these cases a correct usability evaluation of the mobile application can be very difficult since such developers usually have little resources to test their product (for example in a usability laboratory) with a consistent number of potential representative users. In the worst scenarios a usability test plan is simply absent.

The MIDE tool described in the present paper is meant to address the latter challenge.

DESIGN PATTERNS

A few years after the seminal work by Christopher Alexander [14], who introduced the design pattern concept in the architectural domain, researchers in HCI recognized the approach as especially appropriate to user interface and interactive system design [1,5,12]. A design pattern is a general reusable solution to a commonly occurring problem, formally documented in a given field of expertise. Its traditional structure (usually known as the Alexandrian or canonical form) is made up of the following sections: Name of the pattern, Problem and Context, Forces, Solution, Examples, Positive and negative consequences, The rationale, The known uses, Related patterns. Design patterns can be used in two different manners, namely as a

simple collection of ready to use solutions where each pattern has no relationships with other patterns or combined together to form a complete language for specific domains. Several pattern languages have been introduced, as a *lingua franca*, by which not only are the interface designers able to share their expertise with one another, but also an effective participatory design process can be carried out, where potential users are actively involved [6,7]. However, despite their benefits and advantages, the correct usage of design patterns can be difficult for novice users. In fact, as discussed also in [4], one of the main problems can be the lack of expertise in the identification of the pattern that best suits user’s needs. Furthermore, for what concerns pattern languages, important factors such as the user’s background or tight project schedules can constitute a problem limiting the actual usage of the language itself [2]. Such issues are certainly accentuated in the mobile world where the individual application developer might have little knowledge of design principles or have no time to perform a state of the art review of the user interface guidelines for the chosen mobile platform. For example, according to the design guidelines suggested by Google, in the Android platform the action bars that can be used to switch among the various application screens should be always placed at the top of the screen. Putting them at the bottom may originate confusion for the final users resulting in a bad and inconsistent user experience. Moreover, design patterns often represent generic solutions and their adaptation to the real problem can constitute a further element of difficulty, especially when combined with the need to design a user interface consistent with the general look and feel of the underlying mobile platform. Finally, although the solution provided by a pattern should be independent from a specific technology, in practice in the context of HCI there are patterns that provide solutions at a high abstraction level as well as patterns that deal with specific interaction paradigms and technologies, such as the windowing systems commonly available on traditional desktop operating systems [3].

MIDE - MOBILE INTERFACE DEVELOPMENT ENVIRONMENT

As mentioned before, usability principles for mobile interface design are not taken into account by the rapid prototyping tools available to non-professional developers, such as the one supplied with the Android Software Development Kit. In fact, the only goal of such tools is the automatic generation of the user interface source code according to the graphical widgets previously chosen by the developer.

Starting from those considerations, our proposal aims at helping developers with the design of mobile user interfaces that not only adhere to the Android platform guidelines proposed by Google, but that also reflect the best practices of usability design, dictated by widely used design patterns for the mobile world. In order to offer effective support to

mobile application designers, in MIDE some popular mobile design pattern catalogs [7,9,10] are embedded inside a list of common application templates along with a list of the most common features available in current mobile applications. For what concerns, instead, the specific Android design guidelines, MIDE currently supports Google recommendations for the branch 4.x of the operating system. In fact, starting with the version 4 of the platform, Google has put a lot of effort in standardizing the look and feel and provided complete guidelines to develop applications cohesive with that look and feel. According to the official documentation [15], the common structure of a typical Android interface is made up of the following four elements: the main action bar showing the most important actions available for the specific application, the view control used to select the various application screens, the content area that displays and manages the effective contents of the application and, finally, the split action bar used to provide additional controls. Moreover, Android offers three system themes for the 4.x branch namely “Holo Light”, “Holo Dark” and “Holo light with dark action bars”.

MIDE can be used in two complementary ways: as a step by step wizard to rapidly generate the user interface skeleton of a typical Android mobile application or as a collection of commonly used functionalities that the user can manually compose in order to design the user interface. The general idea is therefore to bring design knowledge closer to non-experts. In the wizard configuration, the user can choose among a predefined set of application templates. Such templates encompass the general structure of common mobile applications such as an image gallery or a news application. According to the chosen template the user can customize the behavior of the proposed interface simply choosing among a proposed set of alternatives. Each alternative is a well-recognized pattern for the specific task. For example in the “Data Entry” section of the Organizer template, for the selection of a single value from a predefined set, the user can choose among solutions such as Sliders or Spinners. Since these patterns are generally the most used, the choice to use a text field for this task is simply not provided in the available options. Figure 1 shows the preview window of the News template. In the common functionalities configuration a collection of “ready to use” user interface snippets are provided to the designer. In this modality, the user interface of MIDE is divided into two main working areas: the list of mobile functionalities and the panel where the user can “build” the interface of his/her application simply dragging and dropping the chosen functionalities in the desired order. The proposed layout and behavior for each single functionality are the result of the application of one or more well recognized design pattern in a totally transparent manner for the non expert developer. For example, the “Login” functionality not only presents the traditional set of controls such as the text fields for the insertion of username and password or the

buttons to confirm or cancel the action but it also takes into account the need to validate user input or to provide adequate error messages (see Figure 2). According to current best practices, the suggested text for those messages will contain only relevant and context related information, avoiding technical details or long sentences that might be difficult to read or have a negative impact on the overall user experience. Moreover, to further simplify user's choice, the list of available functionalities are divided into the classic interaction categories available in mobile applications such as, Authentication, Showing output, Data insertion etc. After the selection of the desired functionality, two options are available: getting more information about the various patterns that contribute to the realization of that functionality or customizing it to the current context of use. Some details that can be customized are, for example, the visual aspect, the size or the accepted input type of a text entry widget. The last option offered by the tool is represented by the generation of .xml files and java classes forming the actual Android source code of the chosen template or snippet. The user can import and use such code in his favorite development environment.

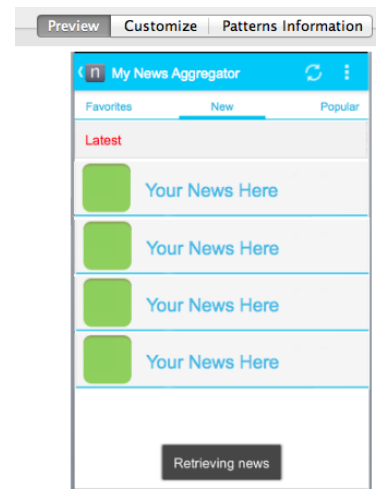


Figure 1: News template example

CONCLUSIONS AND FUTURE WORK

Despite its apparent simplicity, the correct design of a mobile user interface is a complex task. Design patterns provide widely accepted solutions to recurrent problems and since their first adoption in HCI they represent a valid means to deal with design complexity. However, some of their strengths, such as the generality of the proposed solution, can be a source of difficulties especially for novice developers. The MIDE environment presented in the paper embeds the rationale of the best known mobile patterns into

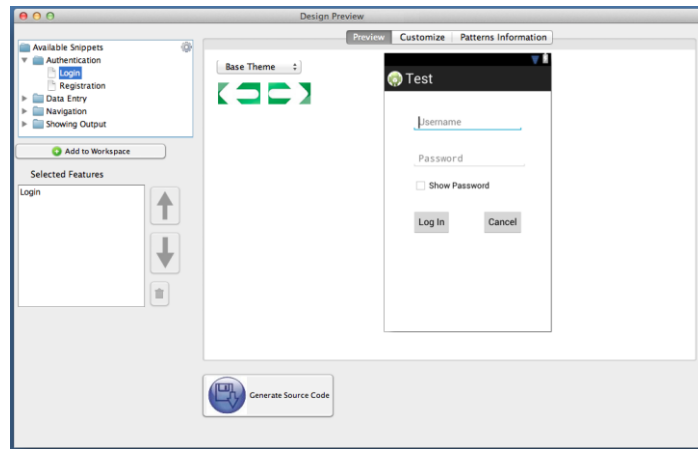


Figure 2: Configuration of common functionalities

concrete implementations providing ready to use solutions to common design issues on the Android platform. At the moment, the tool supports the most important patterns and the source code it generates is explicitly oriented towards the most common screen resolutions available on the majority of current smartphones. In the future, we are planning to add new features and templates but, more important, we are planning to extend the approach to other popular mobile platforms, including Apple iOS and Windows Phone, and make MIDE a cross-platform environment. Moreover an empirical evaluation with bachelor degree students is also planned in order to assess the effectiveness of our proposal.

REFERENCES

1. Bayle, E., Bellamy, R., Casaday, G., Erickson, T., Fincher, S., Grinter, B., Gross, B., Lehder, D., Marmolin, H., Potts, C., Skousen, G. and Thomas, J. Putting It All Together: Towards a Pattern Language for Interaction Design. CHI '97 Workshop SIGCHI Bulletin, Vol. 30 Issue 1 17-23 ACM January 1998.
2. Bernhaupt, R., Winckler, M. and Pontico, F. Are User Interface Pattern Languages Usable? A Report from the Trenches. In Proc. INTERACT 2009, 542-545 Springer.
3. Dearden, A.M. and Finlay, J. Pattern languages in HCI: a critical review. Human computer interaction, 21(1), 49-102.
4. Diaz, P., Rosson, M.B., Aedo, I. and Carrol J.M. Web Design Patterns: Investigating User Goals and Browsing Strategies. End User Development LNCS Vol. 5435 (2009), 186 – 204.
5. Erickson, T. Lingua Francas for Design: Sacred Places and Pattern Languages. In Proc. DIS 2000, ACM Press, New York, 357-368.
6. Ginige, A., Romano, M., Sebillio, M., Vitiello, G. and Di Giovanni, P. Spatial data and mobile applications: general solutions for interface design. In Proc. AVI 2012 ACM, New York, NY, USA, (2012) 189-196.
7. Hooper, S. and Berkman, E. Designing Mobile Interfaces. O' Reilly Media, 2011.
8. Kruschitz, C., Hitz, M. The Anatomy of HCI Design Patterns. In Proc. COMPUTATIONWORLD 2009, IEEE, 202-207.
9. Neil, T. Mobile Design Pattern Gallery: UI Patterns for iOS, Android and More. O'Reilly, 2012.
10. Nudelman, G. Android Design Patterns. John Wiley & Sons, 2013.
11. Paolino, L., Sebillio, M., Tortora, G. and Vitiello G. Framy: Visualizing Geographic Data on Mobile Interfaces. Journal Of Location Based Services, vol. 2(3), ISSN: 1748-9725 (2008) 236-252.
12. Tidwell, J. Designing Interfaces 2nd Ed. O'Reilly, 2010.
13. Todd, E., Kemp, E. and Phillips, C. What makes a good User Interface pattern language? In Proc. AUIC ACM Australian Computer Society, (2004), 91-100.
14. Alexander, C. A Pattern Language. Oxford University Press, 1977.
15. Google Android design guidelines. <http://developer.android.com/design/index.html>.
16. Apple iOS Human Interface Guidelines. <http://developer.apple.com/library/ios/#documentation/userexperience/conceptual/mobilehig/Introduction/Introduction.html>.
17. Microsoft Design Library for Windows Phone [http://msdn.microsoft.com/en-us/library/windowsphone/design/hh202915\(v=vs.105\).aspx](http://msdn.microsoft.com/en-us/library/windowsphone/design/hh202915(v=vs.105).aspx).