A Design Method for People-Oriented Programming: Automating Design of Declarative Language Mashups on the Raspberry Pi

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ABSTRACT

The miniature Raspberry Pi computer has become of interest to many researchers as a platform for building sociotechnical IoT systems for end-users; however, for the end-user to design and build such apps themselves requires new people-oriented tools and design methods. This chapter describes a people-oriented design method called TANDEM and demonstrates the use of it in detail, by way of a case study—the design of a mashup of services and local data stores—that solves the so-called movie-cinema problem. An implementation of the newly designed movie-cinema app is then built within the DigitalFriend, an end-user programmer IDE. Furthermore, a significant part of the TANDEM design method is then automated within the development tool itself. This automation removes the most skilled task required by TANDEM of the end-user: the automation of the process of data normalization. The automation applies data normalization to the initial model of components and data sources that feed into the mashup. The presentation here relies on some understanding of data normalization, so a simple example is presented. After this demonstrated example of the method and the implementation, the authors discuss the applicability of a model achievable by end-users using TANDEM coupled with the automated normalization process built into the IDE vs. using a top-down approach.
A Design Method for People-Oriented Programming

**INTRODUCTION**

With 14 million plus units of the Raspberry Pi having sold (up to mid 2017 and growing: Cellan-Jones, 2017) it is not only a formidable platform for makers and to teach school kids something of coding and computer science, but is also a fully functional Linux machine with desktop level tools together with low level interfaces to all sorts of sensors and physical world devices to be controlled. Single board computers like the Raspberry Pi, have become of interest to many researchers as a platform for building sociotechnical IoT systems (Rizzo et al, 2018), for end users, by end users. It is with this in mind that we have ported the DigitalFriend (Goschnick, 2006) to the Raspberry Pi. Using the DigitalFriend, end-users are able to build mashups of REST and SOAP web services, together with local resources and processes, and information sources including IoT sensors and devices, into newly envisaged and often personalised applications (Figure 1).

While the tools that end-users may use have increased in number and accessibility over the last decade, the methods and design techniques that are targeted at end-user programmers and novice coders, have not followed suit. This chapter describes an end-user-friendly method called TANDEM (Goschnick et al., 2006) and demonstrates the use of it in detail, by way of the design of a mashup of services that solves the so-called movie-cinema problem. An implementation of the newly designed movie-cinema app is then built within an end-user-friendly development environment called the DigitalFriend. While many publications targeted at end-user programmers making mashups, have promoted imperative programming languages for the task, such as JavaScript, PHP and Python (e.g. Orchard, 2005; Feiler, 2008), the DigitalFriend uses CoLoG, a built-in logic programming language. CoLoG features overlap a substantial subset of the Prolog language (Sterling & Shapiro, 1994; Colmerauer & Roussel, 1993), together with added extra-logical predicates concerned with character-based I/O and the GUI interface in order to interact with an end-user, together with some features of a Constraint Logic Language (Marriott & Stuckey, 1998). The use of logic languages is more often associated with AI (Artificial...
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