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A meta-design approach to the development of e-government services ☆, ☆☆

Daniela Fogli *, Loredana Parasiliti Provenza

Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Brescia, Via Branze, 38 - 25123 Brescia, Italy

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ABSTRACT

This paper describes a meta-design approach to the development of online services for citizens of a government agency. The goal is to transfer the development of government-to-citizen services from professional software developers to administrative employees, without forcing employees to acquire any programming skills. The approach encompasses two main phases. The first phase analyzes the different perspectives of the stakeholders involved in service creation and usage – employees, citizens, software developers and human–computer interaction specialists – in order to derive a meta-model of e-government services. The latter applies the meta-model to design and develop an end-user development environment that properly supports employees in creating an instance of the service meta-model, which is then automatically interpreted to generate the service pages for citizens. A pilot application of the proposed approach is illustrated with reference to a specific class of e-government services offered by the Brescia Municipality, even though the approach is general enough to be applied to different kinds of e-government services and application domains. The results of the evaluation with a group of municipality employees provide initial feedback from the government field and show how to proceed along this research direction.

1. Introduction

Government agencies at national, regional and local levels are increasingly integrating Information and Communication Technologies into their processes, both within their organization and in their interfaces with citizens, business organizations and other government agencies. In particular, with the provision of public services on the Web (the so-called *e-government services*), they aim to make services "twice as good, in half the time, for half as much" [1]. In other words, compared with phone and paper channels, online services should save administration costs, be provided faster and be tailored to the needs of citizens and businesses [1].

In this paper, the focus is on Government-to-Citizen (G2C) services [2], which allow citizens to carry out a variety of activities, such as paying taxes, enrolling children in schools, getting a driver's license, asking for an appointment reservation at the government agency to discuss specific problems, etc.[1] We have been involved on this topic by an Italian government agency, the Municipality of Brescia, since 2008 [3]. Brescia is a 200.000 inhabitants-town in Northern

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☆☆ The authors wish to dedicate this paper to the memory of Piero Mussio. During their collaboration with Professor Mussio, they have come to appreciate his original approach to the design and development of interactive systems, which always paid attention to users' language, notation, and system of signs. The research the authors have carried out in the past with Piero Mussio on meta-design and end-user development has stimulated the work described in this paper.

* Corresponding author.
E-mail addresses: fogli@ing.unibs.it (D. Fogli), loredana.parasiliti@gmail.com (L. Parasiliti Provenza).

[1] Let us notice that in this paper the term "service" is used with a more general meaning with respect to the term "web service" (http://en.wikipedia.org/wiki/Web_service).

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Italy, which promoted the use of web communication with citizens since the early years of web technology. The Brescia Municipality currently provides several G2C services on its website (http://www.comune.brescia.it) and, due to the increasing importance that these services are assuming not only for citizens but also for administrative employees, the municipality is interested in making the process of G2C service creation more efficient and effective.

The development of e-government services is now in the hands of the Computer Science department of the Brescia Municipality, because it requires programming skills that can hardly be found outside this department. However, only administrative employees, as experts of government procedures, possess the know-how to structure and characterize a given service. To develop such services, several interactions are thus needed between software developers and administrative personnel, not rarely affected by misunderstandings and ambiguities. This situation witnesses once again the communication gap that often affects the interaction between different stakeholders [4,5].

To cope with this problem, we propose an approach to e-government service development that adopts a meta-design perspective [6] and capitalizes on concepts and ideas deriving from the end-user development (EUD) area [7]. Our aim is to create the socio-technical conditions that allow administrative employees to act as unwitting e-government service developers [8]. Indeed, administrative employees, although expert in the government domain, are usually neither expert in information technologies nor motivated to learn them [3,9]. At the same time, they feel at ease with software systems only when these systems adopt interaction styles consistent with the software applications they commonly use in their work and daily practices, e.g. word processors, spreadsheets or browsers. Therefore, our final goal is to design a software environment that could foster employees' participation in service development, without asking them to acquire additional competencies in information technologies.

In this paper, we conceive meta-design as a human-centered approach, being based on the analysis of the different perspectives of the stakeholders involved in service creation and usage—municipality employees, citizens, software developers and human–computer interaction (HCI) specialists. This analysis leads to obtain different informal and semi-formal service descriptions, from which we have derived a *meta-model* of e-government services. On the basis of this meta-model, we have designed and developed an interactive software application that supports municipality employees in creating an instance of the service meta-model, namely a *service model*. The service model can then be properly interpreted by a web-based application to generate the service pages to be used by citizens.

Our meta-design approach is described with reference to the development of G2C services for reserving appointments at various counters of the Brescia Municipality. We demonstrate the feasibility of the approach by presenting the resulting application for service creation and discussing the results of an evaluation carried out with six employees from different municipality departments who usually provide assistance to citizens through their counters.

The paper is organized as follows. Section 2 reviews the background and related studies that have been inspiring for the present work. Section 3 provides a classification of e-government services, focusing on those services provided by the Brescia Municipality, and discusses some emerging needs. Section 4 introduces a multi-faceted description of services while Section 5 explains how such a description guided us in the definition of a meta-model of e-government services. Section 6 illustrates the characteristics of the EUD environment developed to support administrative employees in creating instances of the meta-model. Section 7 presents the system at work during the creation of a service for the Public Education sector of the Brescia Municipality. Section 8 discusses the method adopted for system evaluation and the results obtained. Finally, Section 9 concludes the paper.

2. Background and related work

In the development of current interactive systems, including e-government services, a variety of aspects must be taken into account: (i) the technologies involved; (ii) the interaction experience one would like to provide users with; (iii) the mental model that users have of their tasks; and (iv) the domain competencies necessary to develop useful and pertinent applications. These different perspectives are usually expressed by using different languages, notation, and systems of signs thus giving rise to communication gaps among the different stakeholders cooperating in the design of interactive systems (design level) and between systems and their end users (use level) [4,5].

To cope with this problem, a variety of approaches have been proposed over the years. We mention in the following the most influential for our work.

2.1. User-centered and participatory approaches

User-centered approaches [10,11] to interactive system design have been initially proposed to bridge the communication gap occurring at use level. User-centered design may involve consultation with users to acquire knowledge about work activities, procedures, standards, users' habits and needs. User involvement is obtained by means of questionnaires, meetings, interviews, and user tests. Some of these techniques can support, for example, task analysis and specification with the purpose of providing a logical description of what users want to accomplish with the interactive system [12]. User-centered design can also be supported by design rationale methods, which aim to create documentation about decisions made by designers showing also the reasons that underlie decisions themselves [13]. However, various experiences suggest that this passive role of users in system design is not always sufficient to meet user requirements, but there is the need to give users a voice, allowing them to participate actively in the design of interactive systems [14].

Participatory design approaches [15] suggest a more active involvement of end users throughout the system design process. According to these approaches, an interdisciplinary design team is usually set up by including representative end users and HCI experts, beyond software analysts