Application of Ambient Intelligence in Educational Institutions: Visions and Architectures

Vladimír Bureš, Faculty of Informatics and Management, University of Hradec Králové, Hradec Králové, Czech Republic
Petr Tučník, Faculty of Informatics and Management, University of Hradec Králové, Hradec Králové, Czech Republic
Peter Mikulecký, Faculty of Informatics and Management, University of Hradec Králové, Hradec Králové, Czech Republic
Karel Mls, Faculty of Informatics and Management, University of Hradec Králové, Hradec Králové, Czech Republic
Petr Blecha, Faculty of Informatics and Management, University of Hradec Králové, Hradec Králové, Czech Republic

ABSTRACT

The ambient intelligence concept provides a vision of society of the future, where people will find themselves in an environment of intelligent and intuitively usable interfaces. The manuscript applies this definition to the specific environment of higher education in the context of the Czech Republic. The existence of the so-called Generation Y and characteristics of included individuals represent the main rationale of this paper. In particular sections of this paper, three visions that focus on intelligent assistance for graduation thesis preparation, smart lecture halls, and smart university campuses are described, and related architectures are depicted. Furthermore, results from a survey evaluating three main aspects - feasibility, willingness to use, and accessibility of technologies - of these visions are presented.

KEYWORDS

Ambient Intelligence, Architecture, Higher Education, Smart Environment, Vision

INTRODUCTION

As is well known, the concept of ambient intelligence (AmI) was introduced in the European Committee’s IST Advisory Group (ISTAG) report (Ducatel et al., 2001) and interpreted by, for example, Corno and Razak (2015), Manwaring and Clarke (2015), Remagnino et al. (2005), Snijders (2005) and others. This concept provides a vision of society of the future, where people find themselves in an environment of intelligent and intuitively usable interfaces, ergonomic space in a broad sense, (1) encompassing better, secure and active living environments around them, (2) capable of aiding them with daily chores and professional duties by recognizing the presence of individuals, (3) reacting to it.
in a non-disturbing, invisible way, and fully integrated in the particular situation. Nearly synonymous concepts of disappearing computing or calm computing express the technology diffused into everyday objects and settings (Russell, Streitz & Winograd, 2005). From the technological point of view, AmI shifts to the conception of ubiquitous computing, the term firstly used by Mark Weiser in the 1990s (Bardzell & Bardzell, 2014; Bohn et al., 2005). Ubiquitous computing is defined as the use of computers everywhere and is determined by interactions that are not channelled through a single workstation.

The AmI environment is characterized by the merging of physical and digital space. It means that tangible objects and physical surroundings acquire a digital representation (Kameas, Mavrommati & Markopoulos, 2005). The AmI environment is considered to host several ubiquitous computing applications.

The philosophy of AmI offers a conception of the environment that will be sensitive and responsive to the presence of humans. The AmI idea builds on advanced results of interdisciplinary research. The development of AmI applications is a complex task and all their features and functioning can hardly be predefined or forecasted because of different emergent or synergic effects.

We believe that educational institutions in general, and especially universities, are among the promising application domains where experimenting with AmI solutions could be quite fruitful. This is a knowledge-rich environment, where intelligent support from the side of the environment can be very beneficial for all types of expected users, and users (students, lecturers, and other staff) are expected to be open to new technologies and approaches.

The objective of this manuscript is to present selected ideas supporting the vision of smart environments for higher education in the Czech university settings. More precisely, this vision aims at envisaging a truly intelligent environment for education where access to relevant knowledge or information will be as easy as possible, relevant to the level of students’ skills and suitably supporting the teachers’ lectures or practices. In such an environment, any kinds of information- and knowledge-related problems would be solved immediately using an appropriate support from the environment, where studying will be a real pleasure.

The organization of this manuscript is as follows. After the introductory section, selected issues related to AmI applications in the educational process and the Net Generation concept as a basic element of tertiary educational processes are outlined. Then, three particular AmI visions for universities are presented, and possible application architectures for these visions are suggested. The results of a brief questionnaire are the presented, where general remarks are discussed. The final section concludes the manuscript.

AMI TECHNOLOGY IN THE EDUCATIONAL PROCESS

Several implementations of AmI technologies have already been presented in the literature. For instance, Kadar, Muntean and Marina (2014) introduce an environment enabling the development of a personalized and adapted curriculum for engineering education. Mathioudakis et al. (2014) present real-time teacher assistance in technologically-augmented smart classrooms. Borrego-Jaraba et al. (2013) offer a near field communication (NFC) based, context-aware solution for access to bibliographic sources in the university. However, although various applications may be created, all solutions have to be grounded in understanding individuals’ requirements and needs. The psychological theories of different types of intelligence can help to understand human reasoning and human interaction with machines. Each individual possesses diverse types of intelligence (see e.g. logical, linguistic, musical, spatial, interpersonal and other intelligence (Gardner, 1985), or analytic,
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