International Journal of Environmental and Ecology Research
www.environmentaljournal.in
Online ISSN: 2664-7117; Print ISSN: 2664-7109
Received: 04-11-2018; Accepted: 05-12-2018; Published: 05-01-2019
Volume 1; Issue 1; 2019; Page No. 25-26

Smart environment: A primer

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Abstract
Smart environments are physical world that consists of interconnected smart devices. A smart environment is realized with with sensors, actuators, and computational elements, embedded into everyday objects and connected through a network. It is a system where individual components collaborate to reach an overall goal. This paper provides a brief introduction to smart environment.

Keywords: smart environment, intelligent environment, human-centered computing, ambient intelligence

Introduction

Computing devices permeate all aspects of modern living. They are found in living and working environments. Smart objects and smart environments are basic components of the Internet of things (IoT). Smart environments (SE) are context- aware, possess a degree of autonomy, adapt themselves to changing conditions, and communicate with humans in a natural way.

The word "smart" means intelligent, while the word "environment" means our surrounding. The term "smart environment" is used differently to refer to smart rooms, smart houses, smart health care, and smart laboratories. 'A smart environment must be able to determine and predict the location of an individual. The predictive feature relies on tools from artificial intelligence.

Basic features

A smart environment (also called ambient intelligence) is a physical space where different kinds of smart devices are working together to make inhabitants live more comfortable. Smart environments include smart cities, smart houses, smart classrooms, smart offices, smart factories, smart workplaces, and other smart areas.

Poslad differentiates three different kinds of smart environments for systems, services and devices [1]:

- *Virtual computing environments* enable smart devices to access pertinent services anywhere and anytime.
- *Physical environments* may be embedded with a variety of smart devices of different types.
- *Human environments* inherently form a smart environment for devices. However, humans may themselves be accompanied by smart devices such as mobile phones.

The three main goals in smart environment are to learn, to reason and to predict. In other words, smart environments need to learn how their environment works [2].

Enabling technologies

In order to enable smart environments, a number of smart items have to cooperate with each other and interact with the user in a coordinated manner. Enabling technologies include [3]:

- *Smart devices and systems*: sensors, controllers, RFID, Blue tooth devices, wearable computers;
- *Wireless mobile communications:* personal and body area networks, wireless LANs, ad hoc and sensor networks, cellular networks
- *Computing paradigms:* Distributed computing, grid computing, mobile computing, pervasive computing, and autonomic computing.
- *Middleware:* Agent technologies and multi-modal human computer interfaces.

Recent developments in artificial intelligence, machine learning, social robots, positioning systems, cloud technologies, and multimedia are also instrumental in advancing smart environments research.

Applications

There has been an increase of research projects focusing on the development of smart environment technologies. Smart environments are specifically designed to assist their users or inhabitants. They may be living environments that are aware and responsive to the user needs. Application areas of smart environments include the following.

- *Smart Learning Environments*:These are very popular and f requently used recently. Many smart cities offer the necessary infrastructure and services to enhance a number of formal and informal learning activities. Smart environments can enrich the learning experience of students. They can be naturally regarded a new approach of computer enhanced le arning, with a number of new facilities. The smart environments need to use big data and learning analytics

- Techniques to integrate real-time information about learners' location [4, 5]
- *Senior Citizen Smart Living Environments*: Many countries are facing a problem dealing with the increasing numbers of senior citizen and how to take care of them. Smart environment may better fulfill the needs of special users such the senior citizens. Smart environment can offer ways in coping with the need of caretaking personnel and the rising costs of taking care of the elderly people [6].
- *Smart Home Environment*: These are environments equipped with devices and appliances, which are usually controlled by a gateway. Through the Internet of Things (IoT), modern homes may be rapidly transformed into smart environments. As illustrated in Figure 1, a smart home serves the function of connecting a variety of conventional digital devices. It enables various kinds of intelligent equipment and devices to be connected on a network [7]. Compared with the traditional home environmental, the temperature, humidity and illumination data are collected in real time.
- *Smart Hospital Environment*: A smart environment can be designed to facilitate people's experience in the hospital or smart health environment using different sensing and actuation technologies. It can be applied to support behaviors of patients and hospital management. In a smart environment, patients need register their smart phones through which the smart system can return related information to patients. Smart environments can provide patients with self-management services and tools that can empower them to live more independently. Such environments are capable of sensing, processing and relaying patients' health [8, 9].
- *Smart Work Environment*: Smart workplace has the characteristic of being able to access information inside the company from outside the company through cloud computing technology. This requires no location and time constraints because mobile terminals such as smart phones are used [10].

Other smart environments include smart city, smart factories, smart supermarkets, smart grid environment, and smart laboratory.

Benefits and challenges

Smart environments offer a vision of unobtrusive interaction, where our surroundings interpret, anticipate, and react to user's needs. Despite growing exploitation of smart environment, the problems of human interaction with SE remain unresolved. There are also unsolved safety-related challenges.

Conclusion

We live in increasingly connected communities. Smart environments embody this trend by linking smart devices to everyday settings and commonplace tasks. Smart environments refer to dynamic ensembles of devices those offer individual services to the user in an unobtrusive manner. They are sensitive the needs of occupants, can anticipate their behavior, and respond accordingly.

References

1. Smart environment, *Wikipedia*, the free encyclopedia https://en.wikipedia.org/wiki/Smart_environment
2. Simi K, *et al*. A model of smart environment for e-learning based on crowdsourcing, Journal of Universal Excellence, March 2015, A1-A10.
3. Das SK, Cook DJ. "Designing and modeling smart environments," Proceedings of the 2006 International Symposium on a World of Wireless, Mobile and Multimedia Networks, 2006.
4. Kadar M. Smart learning environment for the development of smart city applications, IEEE 8th International Conference on Intelligent Systems, 2011, 59-64.
5. Gros B. The design of smart educational environments, Smart Learning Environments. 2016; 3:15.
6. Pulli P, *et al*., "User interaction in smart ambient environment targeted for senior citizen," Medical & Biological Engineering & Computing. 2012; 50(11):1119–1126.
7. Shin S, Do K, Ko B. A study of smart power control algorithm using RF communication in smart home environment," International Journal of Distributed Sensor Networks, 2013.
8. Che X, *et al*., "Patient flow scheduling and capacity planning in a smart hospital environment," IEEE Access, vol. 4, 2016, pp. 135-148.
9. Pichierri F, Dimitrova D. Smart environments in the health context, self-management and data protection in the STARR project," International Review of Law, Computers & Technology. 2018; 32(1):174-189.
10. Park S, *et al*. Research on digital forensic readiness design in a cloud computing-based smart work environment," Sustainability, vol. 10, 2018.
11. Chong NY, Mastrogiovanni F. (eds.), Handbook of Research on Ambient Intelligence and Smart Environments: Trends and Perspective. Information Science Reference, 2011.
12. Cook DJ, Das SK. (eds.), Smart Environments: Technologies, Protocols, and Applications. John Wiley & Sons, 2005.