
SmartPlug: Creating Self-Sensing Spaces using Atlas Middleware

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Abstract

A universal sensor for appliances and their location in a home environment is presented along with a brief use case scenario.

Keywords

Self-Sensing Space, SmartPlug, Atlas Sensor Platform, Device Description Language

ACM Classification Keywords

H4.0. Information system applications: General.

Introduction

A ubiquitous environment such as the Gator Tech Smart House (GTSH) [1] provides services that incorporate many sensors and smart appliances. These smart objects lend themselves to other services and allow interaction with users. However, many mundane objects do not have such capabilities. In this paper, we demonstrate the SmartPlug, a tool deployed at the GTSH that integrates everyday appliances such as lamps and fans into the smart house through power outlets and switches. We show a design of the SmartPlug and the automatic integration process through the Atlas middleware and the Device Description Language (DDL).

Concept of Self-Sensing Space

An intelligent environment should be able to recognize the devices and services it has available, interpret their status, and generate a model of the space. For example, in our smart house, the self-sensing application provides a real-time model that reflects the status of all the appliances in the space.

SmartPlug

Implementation: Figure 1 (a) and (b) show the power outlets with a low-cost RFID reader deployed in the smart house. Each electrical device, such as a lamp or a fan, was given a RFID tag that contained information including location about the device [1]. The SmartPlug concept was also implemented for non-pluggable devices such as lights on a wall by measuring the current consumption. Unique current characteristic can be exploited as an ID for the specific device. In this case, when the device is powered on, the current sensor will analyze the signature of the current draw and identify the device.

Integration: To integrate mundane objects through the SmartPlug, we used the Atlas middleware, a service-oriented platform that represents the various devices as software services. When an object is connected to the SmartPlug, it will be recognized and adapted as a service bundle in the middleware, just like any smart device. To achieve this adaptation, we developed the DDL language and its Bundle Generator. Using the latter, the creation of service bundles is done automatically: a descriptor file that specifies the interface of the object written according to the DDL specifications is converted by the Bundle Generator into an OSGi Bundle. After the bundle is created, it is uploaded to the Atlas Bundle Repository. Once the object connects to the SmartPlug, the Atlas middleware will identify it and accesses the repository to

retrieve the service bundle. When a reference for such bundle is loaded, the Self-Sensing Space application will discover the new object and adds it to the interactive real-world model.

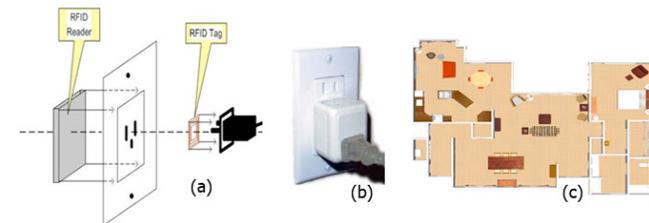


figure 1. (a) Structure of the SmartPlug, (b) Implementation of the SmartPlug in a real smart home, and (c) Real-time 3D image for the representation.

Application Scenario

In this section, we describe an application scenario of the Self-Sensing Space. The exact execution process of the demo will be detailed in a supplement document.

Matilda, a frail elderly with Alzheimer who lived alone in her smart house, had a medical emergency - she suddenly fainted. On receiving the alarm, an ambulance was immediately dispatched. Meanwhile, her caregiver was able to log in remotely and get a real-time 3D image of the house as Figure 1 (c) above. Discovering that the high room temperature might be the cause to the faint, the caregiver found a fan in the interactive model. He right clicked and turned on the fan, giving Matilda the maximum relief possible before medical help arrives.

References

[1] H. Elzabadani, A. Helal, B. Abdulrazak and E. Jansen. Self-Sensing Space: Smart Plugs for Smart Environments, Proceedings of the ICOST (2005).