PROJECT PERIODIC REPORT

Publishable summary

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Project acronym: POBICOS

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POBICOS

Platform for Opportunistic Behaviour in Incompletely Specified, Heterogeneous Object Communities

The goal of POBICOS is to design, implement and test a platform that simplifies the task of developing and deploying opportunistic applications in heterogeneous and incompletely specified object collections for the domain of home automation.

KEYWORDS: Opportunistic pervasive computing, domain-based resource modelling, programming abstractions, middleware, home automation, energy-efficient home

At a Glance: POBICOS

Platform for Opportunistic Behaviour in Incompletely Specified, Heterogeneous Object Communities

POBICOS

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Partners
- VTT Technical Research Centre of Finland *(Finland)*
- Warsaw University of Technology *(Poland)*
- Center for Research and Technology Thessaly *(Greece)*
- Accenture Technology Labs *(France)*
- SAE - Automation, s.r.o. *(Slovakia)*
- Center for Renewable Energy Sources *(Greece)*

Duration:	*38 months*
Start:	*May 2008*
Total Cost:	*3.2 M€*
EC Contribution:	*2.3 M€*

Contract Number: INFSO-ICT-*223984*

Main Objectives

The POBICOS project targets computing environments which feature collections of objects, equipped with sense-compute-actuate embedded nodes, which differ in their sensor, actuator and computing resources. Moreover, the actual mix of objects, and the resources provided by those objects, which will be available during execution is partly unknown when programming the application(s).

POBICOS focuses on developing programming abstractions and corresponding middleware support for opportunistic pervasive computing making it possible for the application to exploit resources in a flexible and transparent way for a range of different environments

POBICOS aims to design, implement and test a platform that simplifies both the development and the deployment of applications for such heterogeneous and incompletely specified systems. The key challenge is to enable applications to take the best advantage of what-ever "resource opportunities" exist at runtime, provided by the objects that happen to be available. The platform shall make such "opportunistic" behaviour largely transparent to the programmer.

Towards this goal, the main objectives of POBICOS are:

- The design of a programming model and supporting mechanisms for opportunistic pervasive computing;
- An ontology-driven approach for modelling and flexibly accessing resources for a given application domain;
- The implementation of a corresponding middleware on top of embedded wireless sensor/actuator nodes;
- The provision of suitable resource abstraction and domain-based customisation tools as well as application development, simulation and deployment tools;
- The experimental validation of the middleware and tools for a selected application domain in the area of home automation.

The domain of energy efficiency at home is the source of scenarios and requirements. Proof-of-concept applications will be tested in a real setting.

Main Results

During the course of the project a platform that simplifies the task of developing and deploying opportunistic applications in such heterogeneous and incompletely specified object collections was designed, implemented, tested and published as open-source[1].

The platform design includes (a) an ontology-based domain model, (b) a programming model for the application design, (c) a middleware architecture, and (d) a end-user model.

According the design a prototype of the platform was created with (a) an example domain model for the home domain, (b) programming tools and a system simulator for application development, (c) a middleware prototype on embedded nodes, (d) an administration tool for the application deployment, and (e) a gateway for legacy KNX installations.

The domain of home automation and energy-efficient buildings provided the context for application scenarios and system requirements. The demand response (DR) application was chosen as main scenario and two system prototypes with DR applications were deployed and tested in a demonstration showroom and an office building featuring several sensing and actuating capabilities.

The large scale experiments (~70 nodes) in the office building were conducted over several weeks while staff was working there normally to demonstrate that the POBICOS platform can be deployed in a real-world environment. The DR application was controlling resources like the lights and heating in the offices via the commercial building energy management system based on sensor data also from wireless sensor motes that were deployed in the office building by the project team. While the experiment was running the energy consumption of the building was reduced during simulated energy prize peaks with tolerable impact on the working conditions in the offices. A widely-used POBICOS platform combined with opportunistic energy-saving applications could significantly reduce the CO_2 emission of buildings.

Dissemination

Besides the project website[2] the project partners published ten scientific articles and more than 20 students advanced their diploma works (BSc, MSc, and PhD) during the course of the project.

Project results were disseminated at over 40 scientific and industrial conferences. Especially industrial audiences were targeted at four technical fairs and five innovation workshops. Also first steps towards an industrial exploitation of itemized results were made and will be further pursued after the project ends. Therefore the project partners have signed a letter of intent.

Core technology development was done by two research institutes and a university, all with extensive research and prototyping experience in the area of wireless embedded systems. Domain expertise for energy-efficient buildings was provided by a research institute that specialises exclusively in that area. Application development was led by an SME active in the area of embedded systems. Finally, dissemination and exploitation efforts were led by a world-class technology consulting company.
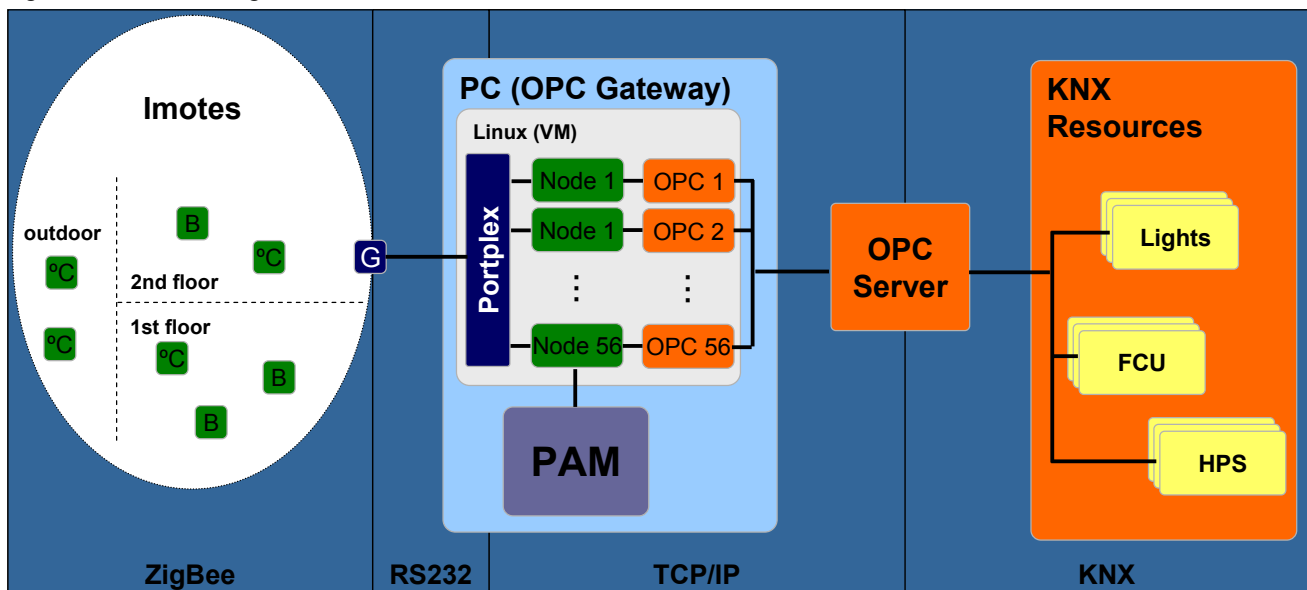
Setup of the large scale experiment

[1] http://pobicos.sourceforge.net/

[2] www.ict-pobicos.eu