UbiComp

Ubiquitous Computing for Knowledge Transfer, Exhibition Design and Museum Operations

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Brief description

This CTI-project consists in developing a prototype of a digital environment to offer different interactive scenarios for museum guests. It means a way to play with events that will initiate interaction through actuators. A number of nodes will generate events under the upper level view of SHARED VARIABLES. Those shared variables simply mean a value corresponding to a stimulus from a sensor, an answer analysis of many sensors, delayed acquisition, filtering or whatever could be useful for a scenario to be played.

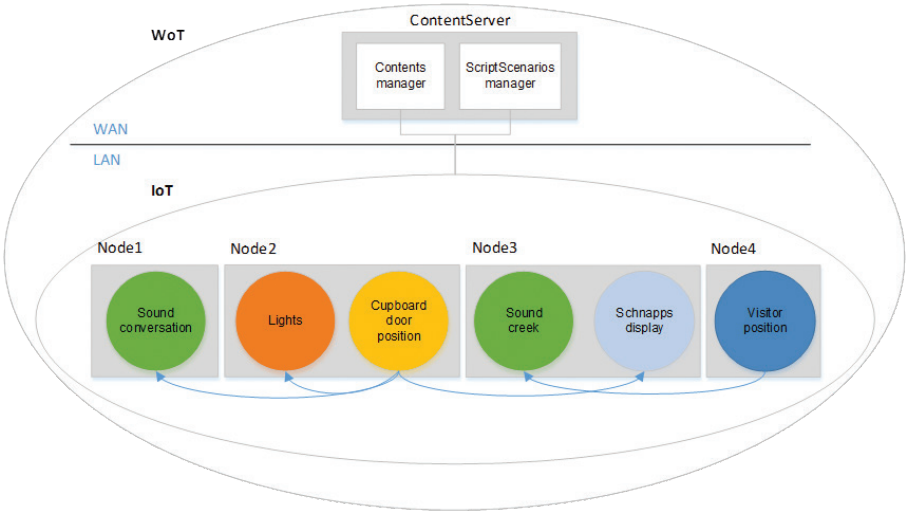
Key points

A node can have 3 different hardware architectures, all of them running Linux. They can be a Raspberry Pi, an FPGA based on Cyclone V with hardcore processors or a small PC. The FPGA allows to design almost every hardware control system that we could imagine.

With this node architecture it is easy to develop new extensions for specific needs of data manipulations.

Nodes can be uniquely identified.

Based on developed scenario designs, some specific boards have been realized.



General architecture of the UbiComp project, Content server, Network, Nodes
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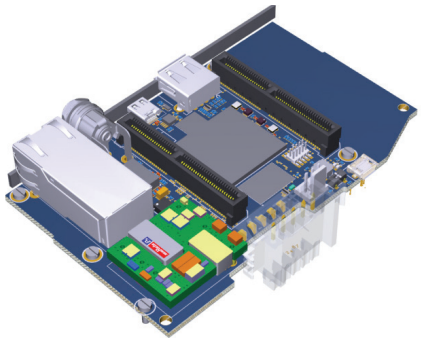
Many different players were involved in the analysis and development of the system:

- Three museums, Swiss Open Air Museum Ballenberg, Roman City of Augusta Raurica, Museum der Kulturen Basel took part in the project. They proposed the scenarios. The partners adapted the implementation to the museum's specific needs.
- The development partners, Atracsys, Fabritastika, Projektil, formed a joint venture: they implemented scenarios from ideas in collaboration with the museums. They have knowledge in programming and competences for the system design and extension. They sell the system's hardware and low level software.
- In the conception and development phase of the product, two Universities of Applied Sciences, HES-SO / Haute école du paysage, d'ingénierie et d'architecture (hepia), and FHNW-HGK / Institute of Experimental Design and Media Cultures (IXDM) were responsible for the full development of the architecture and design development for scenarios, hardware and software.

One of the main needs was to get a distributed system. It could be the size of a small area or of an entire building. Thus, it has to be scalable. The system has to be easily built, maintained, extended and programmed. The global architecture is composed of:

- A Content Management System (CMS) on a server anywhere in the world, accessible through Internet. It contains the data base for the software version of all the nodes, the scripts and the specific hardware configuration.
- The nodes are the units where the sensors and actuators are connected. They have to be interconnected on the same Local Area Network (LAN) by wire cable Ethernet (recommended). WiFi connection could be used but need broadcast of data transmission. The number of nodes is limited to the number of elements that the Ethernet network can support in a single branch.



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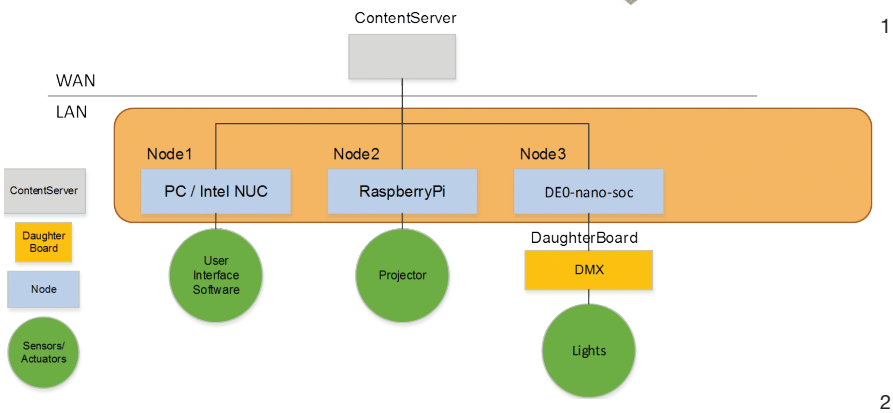

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Output

The prototype of the full system has been developed with FPGA (Field Programmable Gate Array) boards based on ARM SOC-FPGA Cyclo-neV and specific designed extension boards depending on the different scenarios needed. Many tests with the partner's museum have been carried out. Both, the analysis of the public reactions and the way the system was installed, help to specify the new architecture. This work was conducted in collaboration with the main partner Atracsys for the hardware and the infrastructure design.

Special equipment

To set up the whole system, it is necessary to use a PC acting as a content management system. It needs to be powerful enough to contain all the data bases and scenarios with fast response time. For each group of sensor-actuator, a universal board based on an FPGA or a Raspberry Pi or a small PC is necessary. Those units are connected through a local Ethernet network with the highest bandwidth available. All the messages are broadcasted on this network. The next level is the implementation of the requested sensor as infra-red camera, presence detection, light measurement, sound detection or actuators as display, DMX512 projectors, sound generation, video generation, etc.

Legend

1 -View of the new main board for UbiComp
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2 - Global Hardware Elements for UbiComp project. © V. Rumo, R. Beuchat, Atracsys

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