

Yo sé Je

sais I know

Xero Ja

знам I know

Ich weisse Yo

sé Je

I know

Xero Ja

знам I know

Ich weisse Yo

sé Je sais

I know

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**Xero**  
Solution

*Expand  
museum  
experience...*



// AUTO COMMIT TEAM //

**Project:** Xero Solution  
**Team:** Auto Commit Team

**Team members:**

Lončar Nikola  
Ilić Aleksandar  
Đukić Bogdan  
Dimitrijević Ivan

## Problem

**Xero Solution** project (Greek, *xero* – "I know") brings new concepts from the perspective of museums, exhibitions, galleries, which represent educational and scientific institutions. **Xero Solution** brings new user experience for the museum exhibitions by using new technologies. The Authors identified museums, galleries, and other similar exhibition spaces, as unique knowledge repositories, which are not completely or not in the right way exploited.

Using **Xero Solution**, cultural institutions have opportunity to compete with the rest of the entertainment industry, by maintaining their learning function. **Xero Solution** stimulates curiosity, develops museum culture and brakes formal boundaries which are set by physical location.

## Solution

**Xero Solution** is software package, which contains several components:



- **Xero Mobile** – mobile guide through the museum exhibition.
- **Xero KIDS** – dedicated to the children. Mobile application uses game as an instrument for acquiring knowledge on an easy way.
- **Xero Virtual** – static representation of the artifacts is replaced with the virtual model of the museum.
- **Xero Space** – 3D User Interface application for exploring museums, exhibitions and artifacts with rich multimedia experience.
- **Xero Studio** – complete administration of the whole system.

## Basic Scenario

Text below will demonstrate one of possible user scenarios for the **Xero Solution**.

Ana decided to pay a visit to the Nikola Tesla Museum in Belgrade, with her younger sister. Also another visitor is Darko. When Ana enters museum, she gets a PDA device with earphones. Ana's PDA is running **Xero Mobile** application. Her younger sister starts **Xero KIDS** on her PDA device. As Ana walks through museum premises she can hear ambient music, which is enhancing her visual experience. The ambient music fades out when Ana approaches Niagara Falls water-plant model, and she can now hear the sound of the waterfalls.

**Xero Mobile** delivers to Ana appropriate audiovisual narration and content interactively in time and space, which adjusts to her profile and behavior. If Ana would like to know more about specific artifact, **Xero Mobile** will try to satisfy her curiosity by presenting artifacts, which are not part of the current exhibition. However, if that information is not sufficient for her **Xero Mobile** will contact other external museums, which are using **Xero Solution** (e.g. Ontario Royal Museum in Toronto). **Xero Mobile** will present external artifacts, having the same history period and context as the artifact Ana approached.

While Ana is taking a tour through the rest of the museum, her younger sister is playing "Knowledge Hunt" game with other kids, using **Xero KIDS**.

**Xero Mobile** does not have only educational, but it has social purpose as well. Ana was particularly interested in one specific artifact. Darko is also very interested in the same artifact as Ana is. **Xero Mobile** will notify both visitors that they are with the same interest in case they meet each other.

Ana is now leaving museum exhibition. As she approaches museum souvenir shop, the seller will have already known what souvenir to recommend her. This assumption is based on statistical analyses, provided by **Xero Studio**.

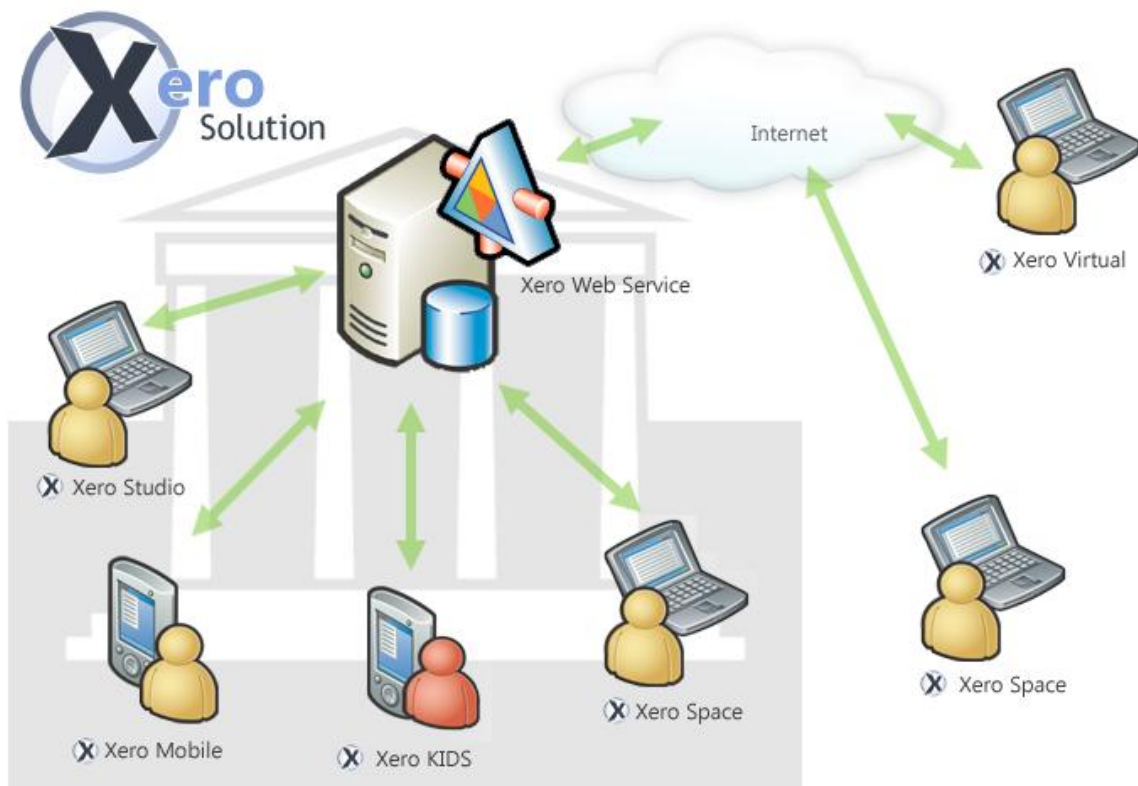
Darko is still taking a tour through museum. He is currently browsing the similar European museums' exhibitions using **Xero Space**.

The next day Ana recommends to her friend from Denmark to visit a virtual Nikola Tesla Museum by using **Xero Virtual**.

## System architecture

**Xero Solution** is based on client-server architecture. Main application logic is on Web Service side. Web Service is communicating with clients inside museum and relates system with institutions which implement the same solution. **Xero Mobile** and **Xero KIDS** are mobile clients which receive contents from Web Service based on user behavior and profile. **Xero Space** expands the PDA applications functionality owing to PDA technology limitations.

Visitor is able to improve his knowledge by using **Xero Virtual** and **Xero Space** from his home.



**Xero Studio** engages all system resources and users. His main purpose is complete administration of system resources for all clients of **Xero Solution** system.

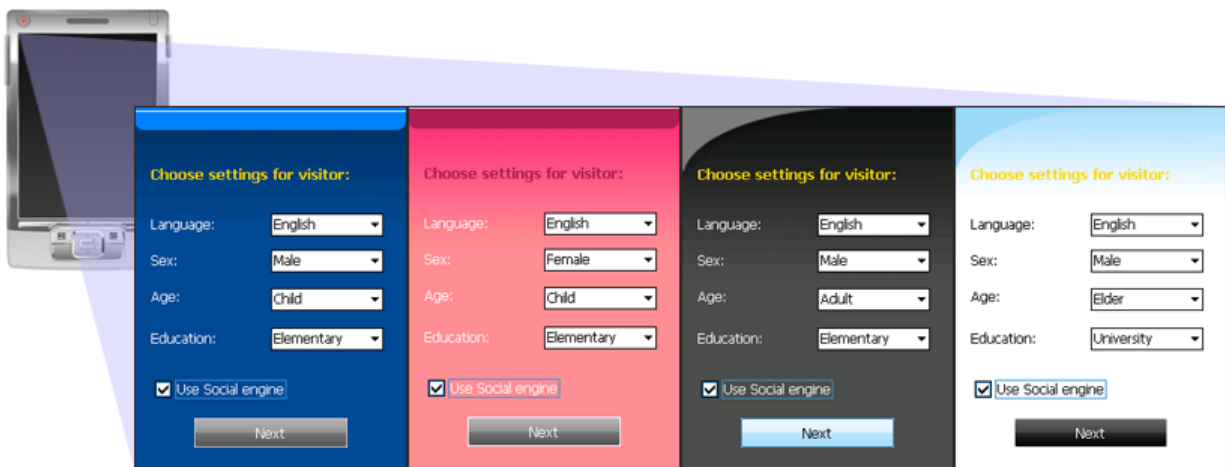
## Xero Mobile

**Xero Mobile** is an application designed for PDA device which substitute museum's guide. Developed in *.NET Compact Framework 2.0*, using *RFID* technology, this mobile application brings a whole new way of exploring museum's space.

### Xero Mobile Features

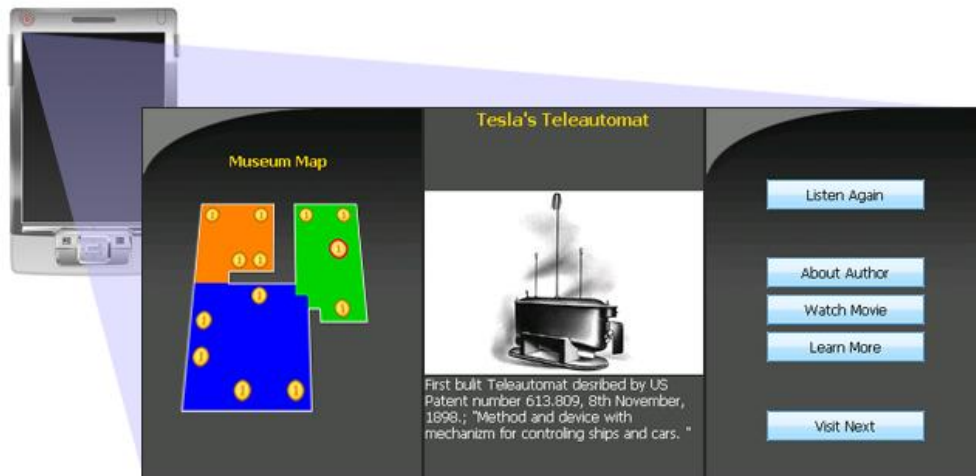
- Exploring current museum's exhibition (textual and multimedia contents)
- Showing contents dynamically, relating to the position and user preferences
- Implemented concepts of ambient intelligence (subset of AI) and user modeling
- Social connecting mechanism which links visitors of the same interest
- Availability of exploring not exhibited artifacts
- Presenting artifacts from other museums which use **Xero Solution**.

After entering museum, you will get PDA device with embedded *RFID* reader. Afterwards you have to adjust your profile in **Xero Mobile** application. User interface is adapted regarding to your age, gender and language.



Having entered in one of museum premises, you hear an ambient music which is related with the premises exhibition. RFID tags, which are placed all over the museum, determine your current position, which can be tracked on **Xero Mobile** map.

After you approach certain artifact, which is *RFID* tagged, you hear the ambient sound. When the sound is over a certain multimedia contents is presented to you. The contents you hear depend on what you have seen so far and how you expressed your interest during tour of the museum.



There are three possible types of visitors based on scientific studies:

- Busy visitor
- Selective visitor
- Greedy visitor

If you are the "greedy" visitor, you will be able to get additional information for not exhibited artifacts, but which is in semantic relation to the artifact currently observed. If that is not enough, **Xero Mobile** application will contact **Xero Web Service Mediator** and send request for similar artifacts from other museums which use **Xero Solution** system. The criteria used for getting that information are historical period and context.

**Xero Mobile** takes care that you explore all artifacts in predefined order. If you skip some artifacts, you will be informed about it. These rules are determined with semantic and hierarchical relations being established upon exhibition creation.

**Xero Solution** besides its educational dimension possesses and social one. The purpose of this social dimension is to connect the visitors of same interests. **Xero Mobile** has the information of your most visited artifact. Finding another visitor with same most visited artifact will result in informing both of you.

If you have some problem you can call museum support from your **Xero Mobile** application anytime.

## Xero KIDS

**Xero Solution** pays special attention to the youngest visitors of museum. While seeking for artifacts, guided with variety of riddles in **Xero KIDS** application, museum artifacts will be presented to the youngest visitors in the most intuitive and exiting way. Playing the game "Knowledge Hunt", a child will compete with other children in museum finding a correct artifact. User interface is adapted to gender and age of child. Child can select an avatar before game starts. Always visible and updated rang list is giving a special note to the game and develops child's competitive spirit.

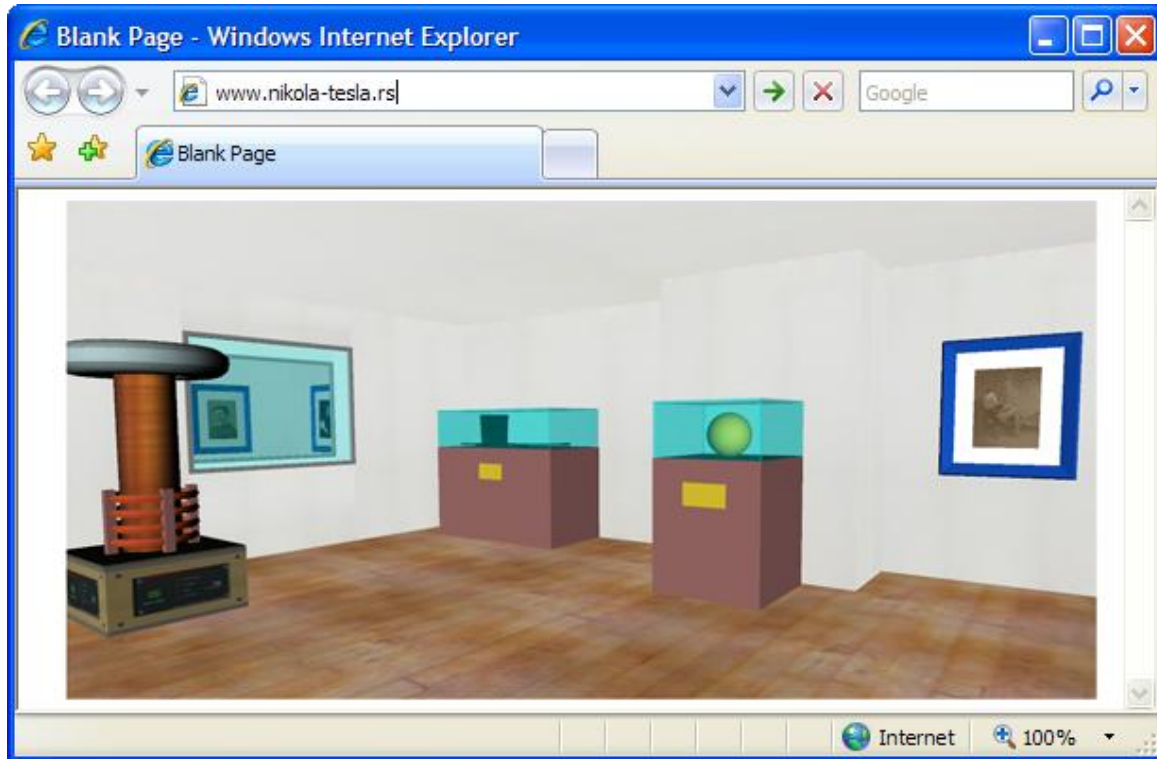


## Xero Virtual

**Xero Virtual** brings to the museum visitor different experience. This part of **Xero Solution** is introducing a virtual environment of museum space. Enchased with rich contents this application allows you to explore virtual museum from every corner of the world. Simple user interface and accessibility are major features of **Xero Virtual**.

With help of advanced visual environment in three dimensions, using only your Internet browser (e.g. *Microsoft Internet Explorer*) you will step into your favorite museum. You will be

able to move through predefined route and examine artifact by artifact. If you prefer, you can choose to explore museum on your own guided only by your exploration spirit.



When you approach to artifact, you will hear a narrator, who will describe it for you. During your visit, a pleasant ambient sound and music will enrich whole experience.

## Xero Space

**Xero Space** brings the usage of the newest technological solutions, in form of presentation and design of the user interface. Developed in the advanced *.NET 3.0* technology (*Windows Presentation Foundation*), **Xero Space** brings improved interaction between visitors and museum. This solution enables you to navigate with user interface by your voice or hand movements.



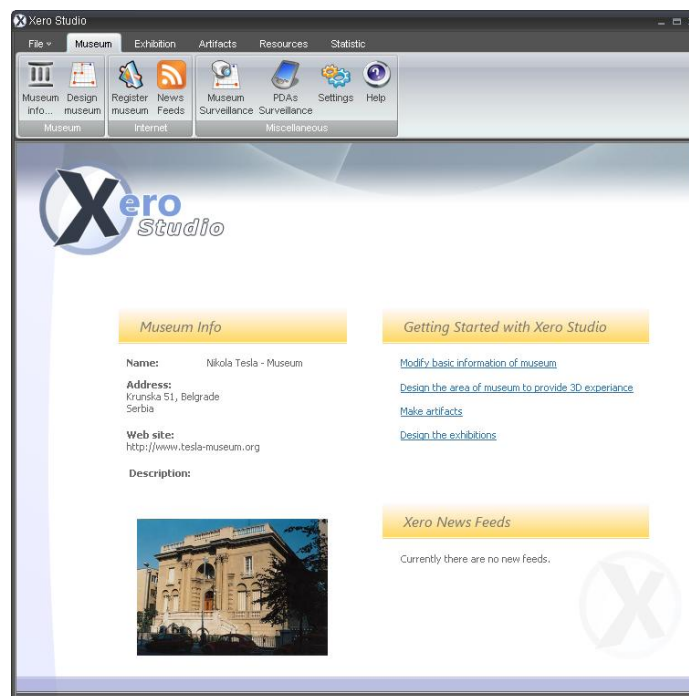
Intuitive work environment adapted by these unusual improvements will make your interaction with **Xero Space** a unique experience. Interaction with application is reduced in three steps: choosing a museum, choosing an exhibition and exploring the artifacts. Every artifact has an additional content in the form of pictures, video materials and narrator's speech.



**Xero Space** can be used in museum as well as at home, which is supported by distributed architecture of the system. Also, there is a possibility of running **Xero Virtual** inside **Xero Space** so that you can virtually tour all museums which use **Xero Solution** system.

## Xero Studio

**Xero Studio** makes **Xero Solution** software package powerful. **Xero Studio** enables the absolute control and administration of whole system. **Xero System** administrator (Curator) is able to completely accommodate the new way of museum presentation which **Xero Solution** offers.



### Xero Studio Features

- Artifacts designing (Every artifact is described by: title, text description, author, historical period and context, pictures, 3D model and other multimedia resources)
- Binding of the artifacts on the basis of hierarchical and semantic connections
- Creating exhibitions
- Designing of 3D museum model based on created exhibitions
- Creating maps which robot guides will use when making a tour of the museum
- Review of statistical data related with museum visitors

Curator should categorize text, used for artifact describing, by level of knowledge which is required so that the visitor of certain profile would understand it. You can use *Basic English Checker* which suggests you, when writing the text about the certain artifact, which words to change in order that the text is in compliance with the vocabulary of Basic English. Basic English is the set of words picked out from the English vocabulary, which the majority of visitors should be able to understand.

Texts that describe the artifact can be bound with chosen multimedia contents. In that way applications of **Xero Solution** package, which uses this knowledge base (**Xero Space, Xero Mobile, Xero KIDS, Xero Virtual**), synchronize the text with multimedia contents using so called *cinematographic* techniques.

Every artifact can be categorized within certain context and historical period. **Xero Solution** offers a possibility of connecting to the all **Xero Solution** systems so that the visitor can get the information about some artifact from any museum.



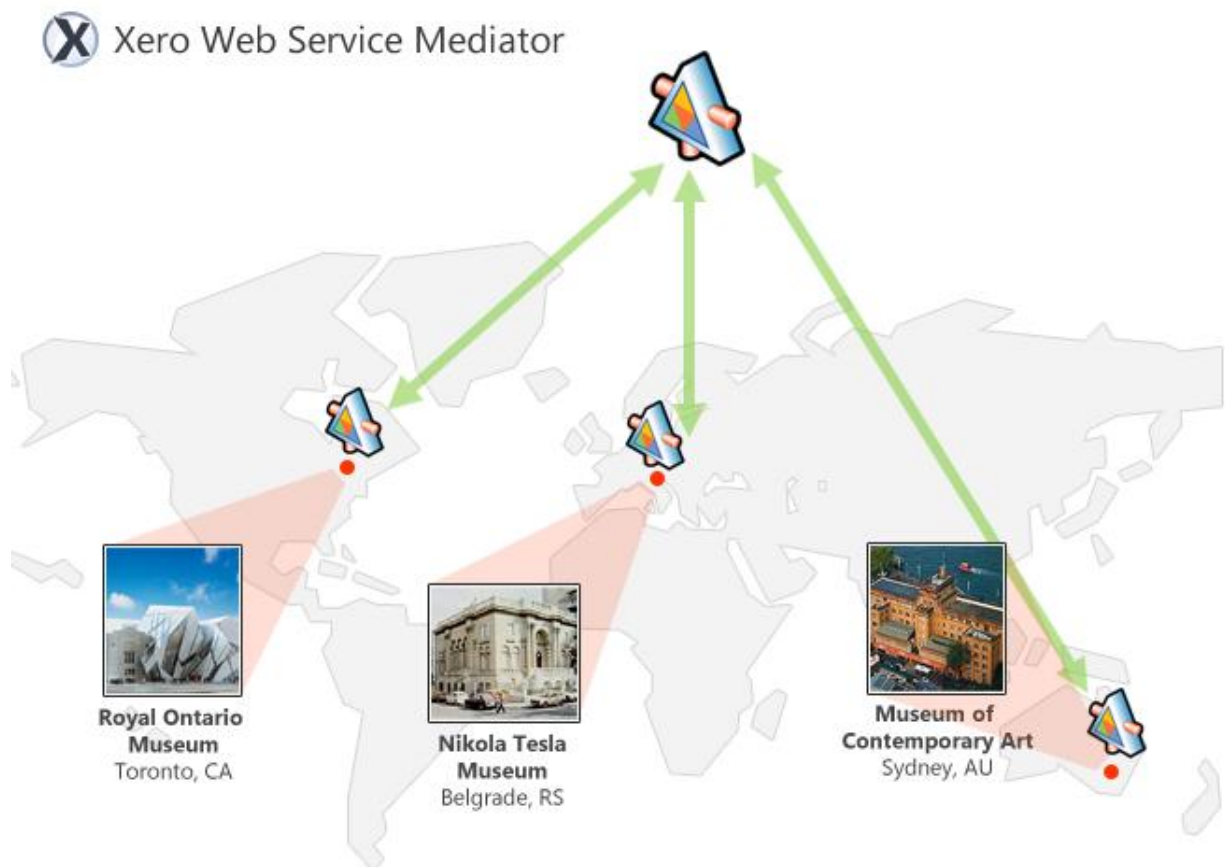
After the artifacts designing, creating of exhibition is the next step. You should choose the artifacts and order them.

**Xero Studio** has engine for designing museum map. Designing of museum is provided in two dimensions (2D) while the result is three dimensional (3D). Curator at first designs the whole space of museum by inserting walls, windows and doors. Then you can mark the premises of museum and attach them a certain ambient sounds.



## Global System Architecture

There are no space limitations for **Xero**. You can use **Xero Solution** to explore artifacts which are located outside of parent museum, nevertheless of its location. Every **Xero Solution** has its own **Xero Web Service**. They are communicating to each other by means of global **Xero Web Service Mediator**.

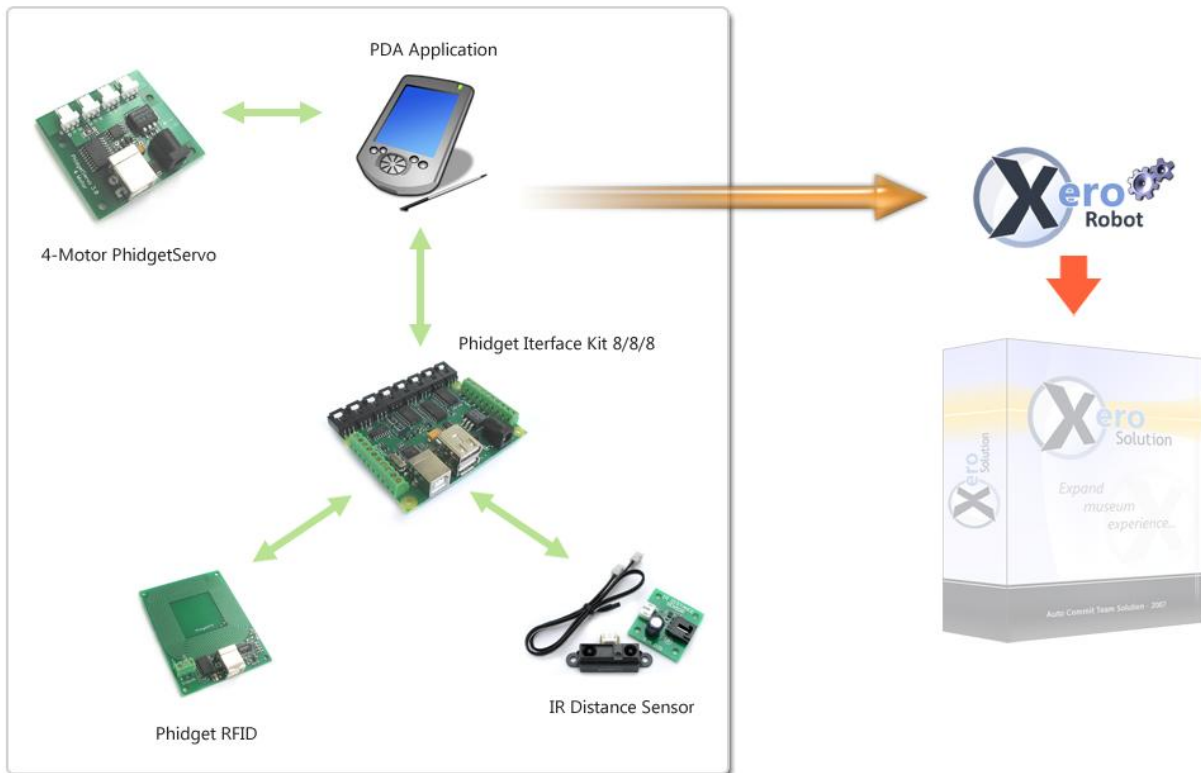


When you need information about artifact which is located in some other museum **Xero Web Service** will call and send request to **Xero Web Service Mediator**. Then **Xero Web Service Mediator** will forward request to all other **Xero Solution** systems. By using of decision making algorithms **Xero Web Service Mediator** will find similar artifact in some other museum and respond to your request.

## The Future

**Xero Solution** is modular system and it has ability to be expanded on an easy way. **Xero Studio** has RSS Feeds system which is able to notify **Xero Solution** about new available upgrades. This new upgrades could be automatically downloaded and installed from the Internet.

**Xero Solution** implemented software components required for robot guide that is in charge of group tours of museum. The only missing part concerns hardware implementation of system which will be realized with *Phidget* components and *Microsoft Robotics Studio*.



**Xero Virtual** application will be expanded by using of *AJAX* technology. In 3D presentation of museum you will be able to see other visitors, to see their movements and to communicate with them. With this upgrade, 3D experience will be more impressive.

## Technologies and Development environments

### Technologies

- Microsoft .NET Framework 2.0
- Microsoft .NET Framework 3.0
- Microsoft .NET Compact Framework 2.0
- Microsoft Speech SDK 5.1 (SAPI)
- Microsoft SQL Server 2005
- Windows Mobile 5.0 Pocket PC SDK

### Development environments

- Microsoft Visual Studio 2005
- Microsoft Expression Blend RC1
- Electric Rain ZAM 3D 1.00
- Media Machines Flux Studio Web3D Authoring Tool 2.0
- Media Machines Flux Player

## Testimonials



// AUTO COMMIT TEAM //

**Auto Commit Team** is the author of **Xero Solution** software package. This project was developed for the **Microsoft Imagine Cup** competition in Software design category.

**Xero Solution** was nominated as the best *e-Culture* content from Serbia in 2007 and therefore participated on the **World Summit Award** competition.

Members of the **Auto Commit Team** were awarded with the **Letter of Thanks** by the **Municipality of Rakovica** for the results which contribute to the development and affirmation of the municipality.

**Xero Solution** will be officially up and running at the **Educational museum** in Belgrade 7th December 2007, during the ceremony for reopening of the museum after the reconstruction.