Touring Machine

Abstract

Touring Machine is an innovative platform designed to offer a new kind of experience in culture for adults and children. It is a personalized, highly customizable tour guide which conforms to the visitor's characteristics and demands.

Our platform uses a powerful description engine which generates descriptions on the fly taking into account elements such as the user's history, language, age and amount of desired information. Additionally, Touring Machine provides multimedia content, optimized for a number of different clients.

It is available in three editions:

- The Mobile Edition targets those visiting an archeological site. Using the phone's GPS it detects the nearby exhibits and presents them to a list, according to their relative position. When the GPS is inactive, image recognition is used to recognize the exhibit.
- The Web Edition delivers a rich experience by virtually reconstructing the 3D space using photographs of the exhibits.
- The Augmented Reality edition is designed to make cultural education more engaging for young students. It virtually replaces predefined symbols with 3D models of the corresponding exhibits, transforming a classroom into a virtual museum.

All editions support features such as advanced question answering, social networking and text-to-speech.

The engine

Descriptions are the most essential elements of sightseeing guiding. Our platform uses a Natural Language Generation engine which produces descriptions on demand. This engine is named NaturalOWL and it is being developed for the last 4 years by the AUEB's Natural Language Processing group, that we are members of.

Our engine is fully customizable. As a result, different descriptions are generated according to the user's preferences and characteristics. Since the text is created dynamically, we can define its various elements, such as the description language, the amount of information included, and the phraseology used. For example, descriptions addressed to kids should be simpler and use less complicated phrases than those addressed to adults. The user just has to define his preferences on the Options page and our engine generates the appropriate descriptions.

Moreover, the visitor's history is taken into account. As a result, comparisons are created between the exhibit that is being described and those previously described (e.g. "Like the statue you saw earlier, this temple was constructed during the archaic period"). This way, touring becomes a special, personal experience. The user's path uniquely defines its guiding. Also, by having access to the visitor's history, the system is able to avoid generating the same information. For example, if a user has already read about what is the *archaic period*, Touring Machine will not explain it again, except if the user asks about it.

Our system can also generate descriptions that include spatial expressions depending on the user's location (e.g. "In contrast to the temple on your left, which was build out of marble, this sanctuary is made of limestone"). GPS indications are vital considering this unique feature.

Other features

Touring Machine enhances user experience providing the following characteristics, too:

- The user may listen to the descriptions through headphones. Text-to-speech conversion is accomplished via Bing Translate API.
- The user may ask the digital guide questions about a specific exhibit (e.g. "Who built this statue?") and get responses in natural language (e.g. "The statue you are viewing was created by the famous sculptor Feidias"). This feature is extremely important, as it turns Touring Machine into a real tour guide.
- Virtual 3D recreation of the location by placing photos of it in their appropriate relative position and orientation.
- Touring Machine loads the photos using DeepZoom technology. This way, it is fully functional even when having to deal with slow Internet connections.
- Our platform is fully integrated with Twitter (other social networks can also be added) enabling the user to view other visitors' comments about tours and exhibits.

  As a result, the most remarkable tours collect better reviews. We also use Twitter to get answers for any question that our system cannot find appropriate data. For example, if someone asks "What other statues were created by Feidias?" and our system cannot

display proper information, we automatically post the question to Twitter, hoping that someone will answer it. Then we process all the answers and we add the new information to our system's ontology. This way, our system is expanded through a broad user community.
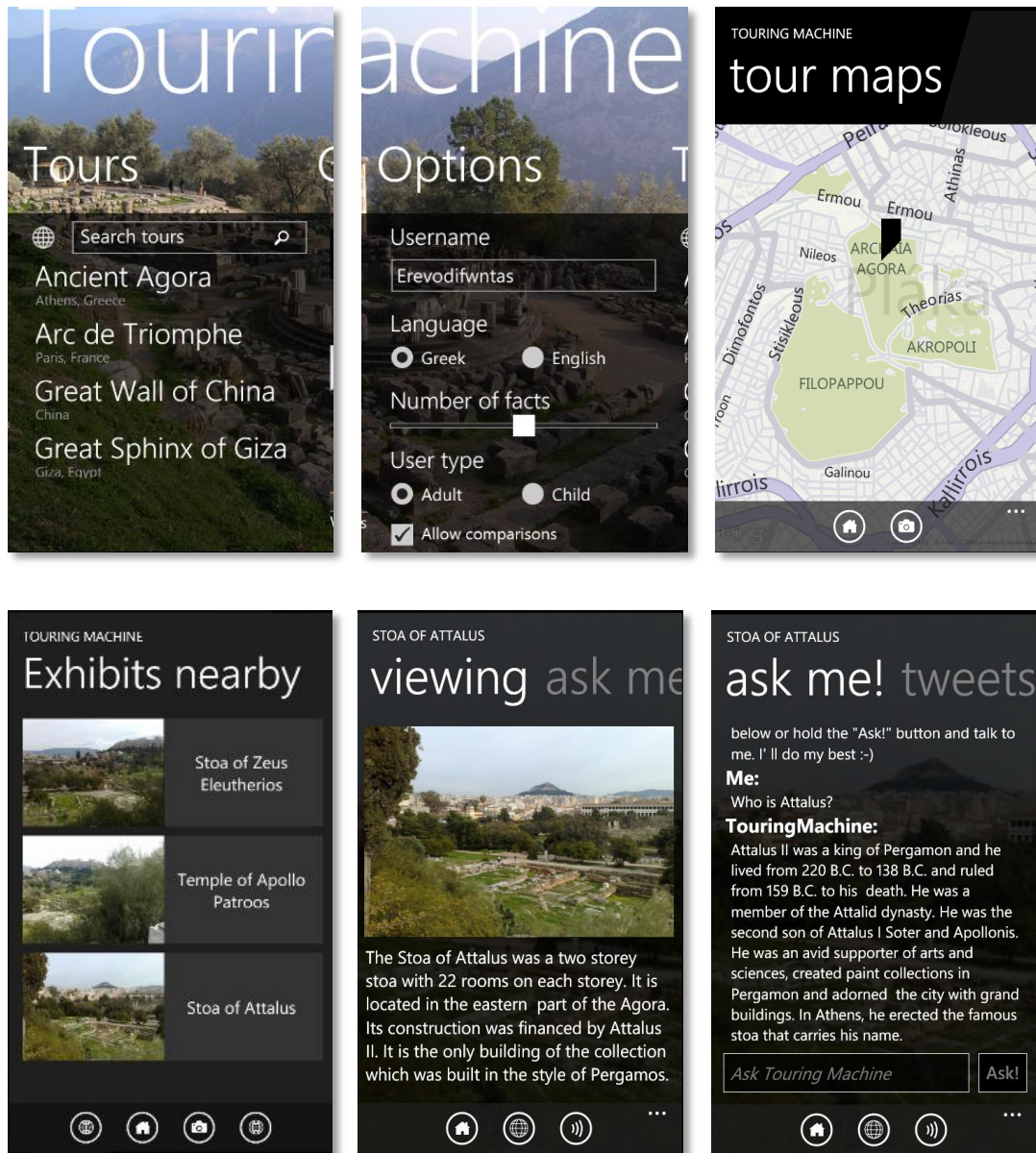
Technologies used

In order to create such a variety of applications and ensure maintainability and scalability, we had to apply a very modular but simple architecture. More specifically, Touring Machine components use the following technologies:

The description engine is based on a natural language generation system named NaturalOWL and developed by our research academic team. This engine pulls data from an OWL ontology (in RDF-XML) and generates the appropriate descriptions. We are using NaturalOWL, because it can take as an input an ontology compatible with the international standard for the controlled exchange of cultural education information, CIDOC-CRM.

To make the description engine easily accessible from different clients, we have used SOAP web services on a GlassFish server.

User data and images are stored in a MySQL database due to its scalability and low cost.

Mobile applications do not have access to the image database, so we have decided to implement image recognition as a separate WCF web service. Twitter REST API is also consumed via WCF services.

Text-to-speech functionalities are provided to the clients by consuming the Bing SOAP web services. We used Bing because it provides a usable API.

Our website is hosted in IIS 7.5, which runs over a Windows Server 2008 R2 operating system. We chose IIS and Windows Server because we wanted to utilize the capabilities of .NET Framework 4, especially considering WCF and DeepZoom.

Clients are developed in ASP.NET, Silverlight and Silverlight for Windows Phone using .NET Framework 4 and JME. Silverlight delivers a rich user experience in the web and mobiles. JME targets feature phone owners.

DeepZoom API is used for converting the images into a format that could be effectively downloaded from any kind of application.