



FROG

FUN ROBOTIC
OUTDOOR GUIDE

Deliverable 2.3

Sensor data and Multimedia database with the virtual content for AR application

Consortium

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Summary

This deliverable reports the multimedia content development and creation for the FROG project. Considering that the objective of this project is to develop a fun robotic guide that can engage with visitors of touristic sites, two types of content have to be considered:

- a) Robot intrinsic content: this relates to content that is specific to the robot as a guide with an engaging and funny personality, independent of the site specific content to be presented. This type of content includes the form of the robot, the guiding behaviors and strategies, among other robot characteristics that are being developed in the specific WPs. Multimedia robot intrinsic content, such as voice, mouth animations, and others are being developed in this work package and are reported in this document.
- b) Site specific content to be presented by the robot: for each of the test sites specific content was created and adapted so that it fits the devised content presentation strategies, namely augmented reality.

Test sites

Although the initially planned test site was Vila do Rabaçal - an ancient roman ruins site in the north of Portugal – during the project planning phase, two other sites emerged as more adequate to the project. Partner UPO, contacted the administration of the Real Alcazar – the most visited monument in Seville, which was extremely receptive to the project and, in parallel, YDreams contacted the Lisbon Zoo with the same results. These two other possibilities presented many advantages when compared with the initially planned site. Real Alcazar and the Lisbon Zoo offer logistic facilities that were not present in the initial site choice; both are located near the aforementioned partners, while Vila do Rabaçal is at a distance of 180 km from the closest partners' location, Lisbon. Another important aspect relates to the impact that the two selected sites may provide to

the project by being highly visited attractions in each city, providing higher media impact in terms of dissemination.

This deliverable reports the multimedia content creation and development for these two locations. The Lisbon Zoo showcase will not be a final test bed, so the content is adapted to the development stage at the moment of presentation – the second year review – and adequate to the specific testing objectives of the system at that moment in the project development.

Sensor data for augmented reality

Augmented reality relies deeply on accurate localization information that allows us to correctly register virtual content in the real world. The initial plan for the definition of the augmented reality registration points was to rely on the concrete localization information provided by partner UPO. One of the ideas was to position fiducial markers in the environment, in the position of each Point of Interest (POI), and to acquire its world coordinates through SLAM algorithms.

A posterior analysis of this task concluded that decoupling those two aspects would facilitate the development, while providing a more flexible way of creating and positioning new content in an existing site or to adapt FROG to new sites. The objective of this new approach is to provide an easy way of setting up multimedia content attached to a particular location in the real world.

A POI has a particular location and orientation in space and can hold multimedia content to be played or exhibited in some kind of relationship with its coordinates.

For example: a 3D object can be rendered into the camera image, according to its position in space. A sound can be played in a predefined vicinity around its location point with increased volume as the robot approaches it. An internal coordinates space is used, so that locations can be specified and edited, decoupled from the other developments. POI locations in content space may be acquired by picking points on a topographic map and their respective

elevations. In runtime, coordinates in sensor space are converted into content space as they arrive and before calculations are performed.

A calibration process is used to align sensor space and content space, that is, to find out the conversion matrix between sensor space and content space. This process consists of specifying to the Multimedia database the sensor coordinates of a commonly known and meaningful point in space.

To facilitate this registration process and the inclusion of new multimedia content a backoffice content application manager is being developed. The GUI is presented in the following image.

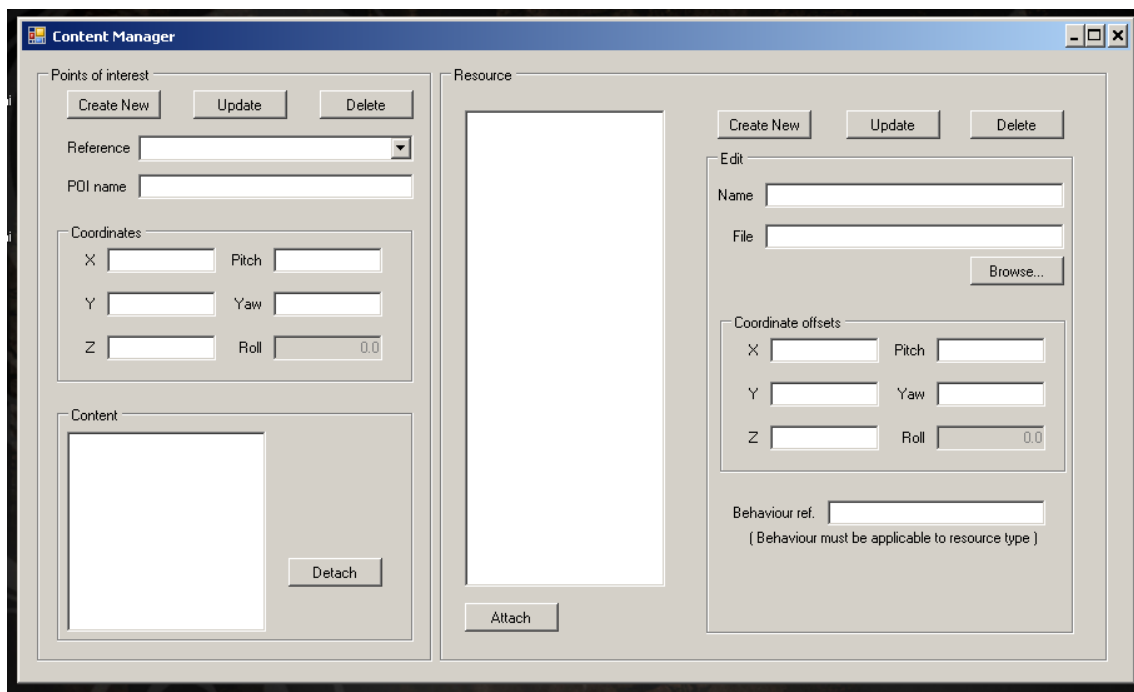


Fig. 1 - backoffice content manager GUI

This backoffice application facilitates the inclusion of multimedia content in the system and the definition of its Augmented Reality properties.

With this approach, sensor data need not to be directly connected with each multimedia object and the registering can be applied and perfected in its own coordinates system.

Audio

Although FROG will not be a conversational agent and its interaction strategies focus mainly on non-verbal cues, audio information will inevitably play an important role. To facilitate the design of verbal content, a text-to-speech engine became a favored option. This way text content can easily be fine-tuned according to user tests without the necessity to record the files again. A text-to-speech engine also facilitates the visit adaptation to different languages.

The Festival Speech Synthesis System from The Centre for Speech Technology Research, University of Edinburgh, has been tested for its adequacy to the objectives, while providing a license type that allows unrestricted commercial and non-commercial use. To establish a more funny and engaging robot voice adequate to each of the test sites, a sound processing modulation will be applied to the text-to-speech output.

Besides the verbal component, sound plays a very important role in communication with others, while reinforcing the mood and providing character personality.

To enhance the movement expressiveness of the robot and to anticipate some of its movements, a set of illustration sounds were created.

Illustration sounds:

- Turn Left
- Turn Right
- Anticipating actions sounds
 - Start moving
 - Stop
 - Start content presentation
- Antenna movements: these illustration sounds will be created after the finalization of the antenna expressive movements' definition and implementation.

Sound can also be an important aspect in augmented reality. By illustrating a specific area in space with a music clip or ambient noise it can enhance the

audience perception of that space during the visit. Research was conducted into possible audio illustrations and is now object of copyright clearance diligences.

Laser pointer/Antenna

The analysis of human guide behaviors and their content presentation strategies highlighted the importance of the action of pointing to the detail they are presenting. The Real Alcazar is a strong example of this practice due to its rich façades and highly ornamented ceilings.

The inclusion of a laser pointer with 3DoF on top of the robot, controlled by the augmented reality engine, allowed the possibility of simulating that strategy. The development of this system permits a quick and effective way of including new augmented reality content. Verbal information synchronized with laser pointing provides a multimodal presentation strategy that can be very effective in sites such as the Alcazar.

Another important role for the laser pointer is as an expressive antenna, something familiar in many robots in films, to enhance robot affective expression. A set of expressive movements are being researched and designed that will enhance the affective communication of the robot.

Another important role in Human Robot Interaction (HRI) that is being researched for the antenna is its capabilities to simulate gaze and attention level in the robot, overcoming the necessity for moving eyes.





Fig. 2 - Antenna/Laser pointer concepts

Visual content

Test site specific

In the case of the Lisbon Zoo and the project's objectives at that stage, the content will rely mainly on verbal communication and content provided by the pedagogic department of the Zoo.

Several meetings and workshops were conducted with the Zoo experts that provided content to be adapted and used in the project. This content offers the advantage of being of high quality and aligned with the message the Zoo wants to express to the public. This content is aligned with the elementary school curricula and conveys a message of respect for nature preservation that is very important in any zoo visit.

In the case of the final test site, the Real Alcazar, research on content led us to establish contacts with two research groups that have developed very important 3D reconstructions of the monument.

The Laboratorio de Arqueología y Arquitectura de la Ciudad (LAAC), universities of Granada and Sevilla, directed by Professor Antonio Almagro, has developed a very detailed reconstruction of the entire Alcazar, reproducing its several eras.

The research work of El Corral de la Montería de Sevilla: metodología y resultados en su reconstrucción virtual, by a group of researchers from the Universidad de Sevilla, coordinated by the architect Juan Ruesga, includes very rich 3D models of an ancient theatre to be presented.

Mediated by UPO, YDreams contacted these research groups, looking to establish a possibility of cooperation with the project. A very enthusiastic reception led to further meetings where the processes and conditions for that cooperation were established. YDreams will adapt the models to be provided by these groups to the context of augmented reality and will rely on their expert consultancy.



Fog. 3 - Examples of 3D models from the contacted research groups

Robot visual content

The FROG robot includes several ways of presenting visual content. It provides a display, which can present site specific content and, alternatively, display the robot expression through mouth animations. During speech it will not try to emulate mouth movements, which are not necessary in the robot sound generation process, but will illustrate its generation through an animation based on frequency analysis.

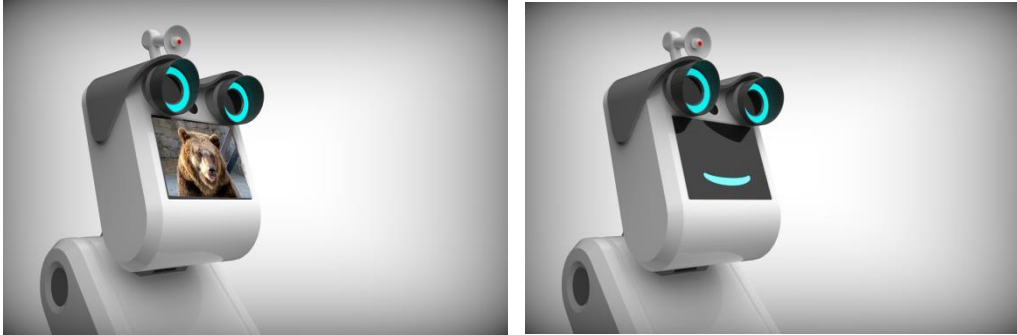


Fig. 4 -Display showing content / Display expressing emotion

Besides the display, FROG includes a video projector in its interior that allows a frontal and a floor projection. Although limited in its application in direct sunlight surfaces, it offers an interesting method for content presentation in shade and semi-indoors areas.

Several tests were conducted during the two meetings in Seville. These, allowed us to adequate the right content to be presented and where to present it. With highly textured buildings and walls, the Real Alcazar required a series of projection tests, with prototype content, that helped identify the most effective to each projection surface. .










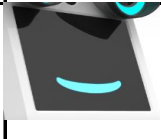

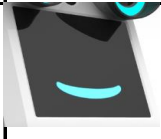

Fig. 5 - Wall and floor projection tests at the Real Alcazar






Transition visual and sound effects






Considering that the FROG robot is not a conversational agent, it is important not to create that expectation in the users. Clearly separating the robot voice from a narrator voice – an expert on the subject – can enhance that perception in the users. Transition visual and sound effects, from the robot mouth animation to narrated content, will mark that separation.


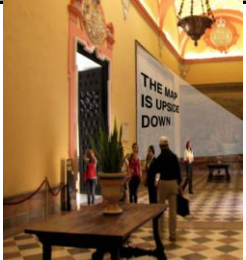

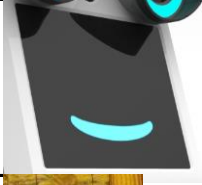


Real Alcazar - Multimedia content

Action	Speech	Sound	Content	Visual output	AR	file name	Thumbnail
Introduction							
FROG introduction	Hello. I am Frog and I am a very special guide here at ALCAZAR. At your disposal. Can I show you around? Follow me!	TTS	animation	Display		Dynamic animation	
	.						
EXHIBIT POINT 1							
POI1-PATIO DEL LEON							
Introduces Patio del Leon	Hey! Come closer! Shall I show you something?	TTS	animation	Display		Dynamic animation	
Highlights the content in site	Do you know that there was a theatre in this patio? Many plays from the 16th century were performed here. Unfortunately it burned down in a fire in 1691	TTS	animation	Display		Dynamic animation	
	Come closer! Have a peek at how it looked inside!	TTS	animation	Display		Dynamic animation	
shows Theatre model in AR			3D model	Display	Yes	theatre.obj	
Guiding	That's it! Would you like to follow me to the next point of interest? Come! Follow me!	TTS	Animation	Display		Dynamic animation	
EXHIBIT POINT 2							

POI 1- PATIO DE LA MONTERÍA							
Introduces Patio de La Montería	This is the main pátio del Alcazar! It has changed a lot through time! Do you want to travel through time? I know a way!	TTS	animation	Display		Dynamic animation	
Highlights the content in site	Now you are in 1356. This is the Middle Ages. A very powerfull catholic King came to live in this palace which once belonged to the muslims. He ordered the construction of this palace, but asked muslim workers to produce it in their style. It's called the Mudéjar Style.	TTS	animation	Display		Dynamic animation	
	You can see the changes this façade went through along the centuries, by looking at my display.		3d model	Display	Yes	patio_monteria.mov	
Guiding	Would you like to learn more about the Real Alcazar?	TTS	animation	Display		Dynamic animation	
POI 2-Porta del Palacio D.Pedro I							
Introduces Porta del Palacio D.Pedro I	Do you know this architectural style is called mudéjar? Come on, I will show you how the King wished to leave his mark on the palace!					Dynamic animation	

Highlights the content in site	Here (pointing at the inscription) he wrote:	TTS	image	Display / LP	Yes	inscription1.png	
	Would you like to follow me to the next point of interest? I will wait here and then we can go to the Gothic Palace	TTS	animation	Display		Dynamic animation	
EXIBIT POINT 3							
POI 1-Patio del Crucero							
shows patio transformations while guiding	This patio went through many changes along the centuries. While we walk you can see those changes in my Display			Display	Yes	patio_crucero.mov	
EXIBIT POINT 4							
POI 1-SALA DE LAS FIESTAS							
Introduces the Hall	Hello! Did you pass the fountain with the figure of the god Mercury? It was the patron of business in Renaissance. The King ordered the decoration of this room to show his power and prosperity.		animation	Display		Dynamic animation	
Highlights the content in site	In this room, the King represents himself and the queen. Look, over here! I will point to the figures of the Queen and King.	TTS	animation	Display		Dynamic animation	

Points to the images of the King and Queen				Laser pointer	Yes		
Guiding	Would you like to follow me to the next point of interest? Come and see the Tapestry Room, follow me!	TTS	animation	Display		Dynamic animation	
EXIBIT POINT 5							
POI 1 -SALÓN DE LOS TAPICES							
Introduces the Room	This room was destructed in the 1755 earthquake of Lisbon. Then it was later restored.	TTS	animation	Display		Dynamic animation	
	Initially it was decorated with the same type of tiles that you will see in next room and I can give you an idea of how it was.		image	Wall projection		tile.png	
Highlights the content in site	Now, it is decorated with a series of tapestries known as "The conquest of Tunis", a commission of the Emperor Carlos V, after his victory in 1535 to the Ottoman Empire.	TTS	animation	Display		Dynamic animation	

points to the tapestry details	Look! Over here! Can you see what makes this map so unusual?	TTS	animation	Display		Dynamic animation	
				Laser pointer / Display	Yes		
	It is represented upside down!	TTS	animation	Display		Dynamic animation	
	This is the map of Mediterranean where in 1535 there was the Tunis Battle.	TTS	animation	Display		Dynamic animation	
	The man on the lower right side is the tapestry author, who portrays himself in order to give authenticity to the events.			Laser pointer / Display	Yes		
Guiding //Thanks the visitor	Thank for your visit. It's been a pleasure! I hope you enjoyed it and I'll be waiting for your next visit!	TTS	animation	Display		Dynamic animation	

Zoo visit - multimedia content







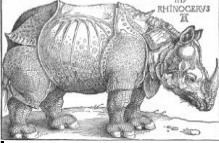
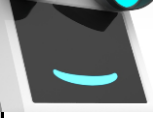





Introduction							
Action	Speech	Sound	Content	Visual output	file name	Thumbnail	Notes
Introduce FROG-ZOO	Hello. I'm Frog and I am a very special guide here at the ZOO. At your disposal... Yes, you can say I am a new species! Shall I show you around? Follow me !	TTS	animation	Display	Dynamic animation		
EXHIBIT POINT 1 – VALLEY OF THE TIGERS							
POI 1							
Introduces Valley of the tigers	Follow me into the Valley of the Tigers. I can show you around!	TTS	animation	Display	Dynamic animation		
Highlights the content in site				Laser pointer			Valley of the tigers has several pannels in situ that are used by guides to present information about the tigers. The idea is to use the laser pointer, simulating the guide strategy
Shows enriching activities			video	Wall projection	tiger_caretaker		
Guiding	That's it! Would you like to follow me to the next point of interest? Come! Follow me!	TTS	Animation	Display	Dynamic animation		
EXHIBIT POINT 2 – NEAR RHINOCEROS							
POI 1 - approaching the Rhinoceros area							
Introduces Rhinoceros	A rhinoceros had not been seen in Europe since Roman times: it had become something of a mythical beast, occasionally confused in bestiaries with the "monoceros". (unicorn),		Animation	Display	Dynamic animation		
POI 2 - In a shadow under the bridge / teleferic station							
	Hello there...! This is the white rinocero. Do you enjoy drawing? How would you draw this animal? Can I show you how others drew this animal?	TTS	Animation	Display	Dynamic animation		
Rinocero mythology	Story of "Durer" rhinoceros		Image	Display	durer		
Further guiding	That's it! Would you like to follow me to the next point of interest? Let's see the lions! I'll meet you there!	TTS	Animation	Display	Dynamic animation		

EXHIBIT POINT 3 - NEAR THE LION AREA							
POI 1 – In a shadow nearby	<p>Hello, Can you see the lions? Are they sleeping?</p> <p>Do you know lions are like cats, they sleep during the day, and then get more active in the evening.</p> <p>But, come on, I can show you a video of these lions in activity!</p>	TTS	Animation	Display	Dynamic animation		
Shows enriching activities			video	Wall projection	Lion_caretaker		
Further guiding	That's it! Would you like to follow me to the next point of interest? Let's see the gorillas!	TTS	Animation	Display	Dynamic animation		
EXHIBIT POINT 4 – Gorilla's Temple							
POI 1 – inside the temple main room	<p>We are now at the Gorilla's Temple</p> <p>Here we can find some of our distant cousins who share many resemblances with us, humans.</p> <p>Do you want to know how similar they are to us?</p>	TTS	Animation	Display	Dynamic animation		
Show primates' characteristics			Video	Wall projection	primates		
Highlights the content in site				Laser pointer			The Gorilla's Temple has several pannels in situ that are used by guides to present information about the tigers. The idea is to use the laser pointer, simulating the guide strategy
Guides to comparison chart	Let's now compare these primates' sizes with your own.	TTS	Animation	Display	Dynamic animation		
End of guided visit	<p>Now you know a bit more about these animals and how the Zoo works to protect them and to reintroduce them in their habitats.</p> <p>Enjoy the rest of your visit and remember to always respect the animals</p>	TTS	Animation	Display	Dynamic animation	