IMPROVING SEMANTIC MODELING WITH THE HELP OF AUGMENTED REALITY

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***Abstract**: A semantic modeling makes it possible to add, in addition to geometric data, as much information about architectural elements.*

In order to create a semantic modeling that has a unitary structure for all geometrically modeled buildings, regardless of who makes this model, it was proposed in this article to create an application based on augmented reality to help semantic modeling of historical buildings on the architectural side. This application will be the basis of semantic annotations in the field of architecture.

When several important buildings have been modeled using the same unitary structure, they can be represented in a semantic Web.

***Keywords:** Digital Model, Augmented Reality, Semantic structure, Ontology, Semantic annotation*

1. Introduction

The conservation, restoration and promotion of the inherited cultural heritage is a challenge for us and future generations, in the context of the emergence and continuous development of new technologies in order to create complex and complete digital models for the digital built heritage.

The Internet is one of the most widely used sources today that can increase people's accessibility to a country's cultural heritage. Therefore, 3D digital models are enriched with semantic annotations that are related to geometric models, for the management of more information related to heritage.

Thus, by gathering an impressive amount of information in the same place, in a single site related to buildings belonging to the cultural heritage, they can be accessed much easier, delighting the user with the varied amount of quality information and positively influencing tourism and promoting national values. But, in order to put more information in one place, in a semantic web, they must have the same unitary structure.

The historical building, as an element of the built heritage, has an exceptional value for a nation and therefore it must be viewed as a whole, with all the built elements that compose it, elements whose individual value must be highlighted.

This article presents the idea of semantic modeling of objects, but also the representation of augmented reality through the semantic context used.

Unlike virtual reality, augmented reality is defined as a mixed reality, it is not only real or only virtual, but a combination of them.

Augmented Reality (AR) was made possible by the increased performance of the computer (especially the graphics part). AR involves the superposition of various 2D and 3D

objects on a real world image. This combination of real and virtual objects can be transposed into a multitude of applications from different fields, these being limited only by our imagination.

2. Semantic Annotation Using Ontology

Semantic annotations are most sophisticated. In the following we will highlight the semantic annotation of segmented objects in the model.

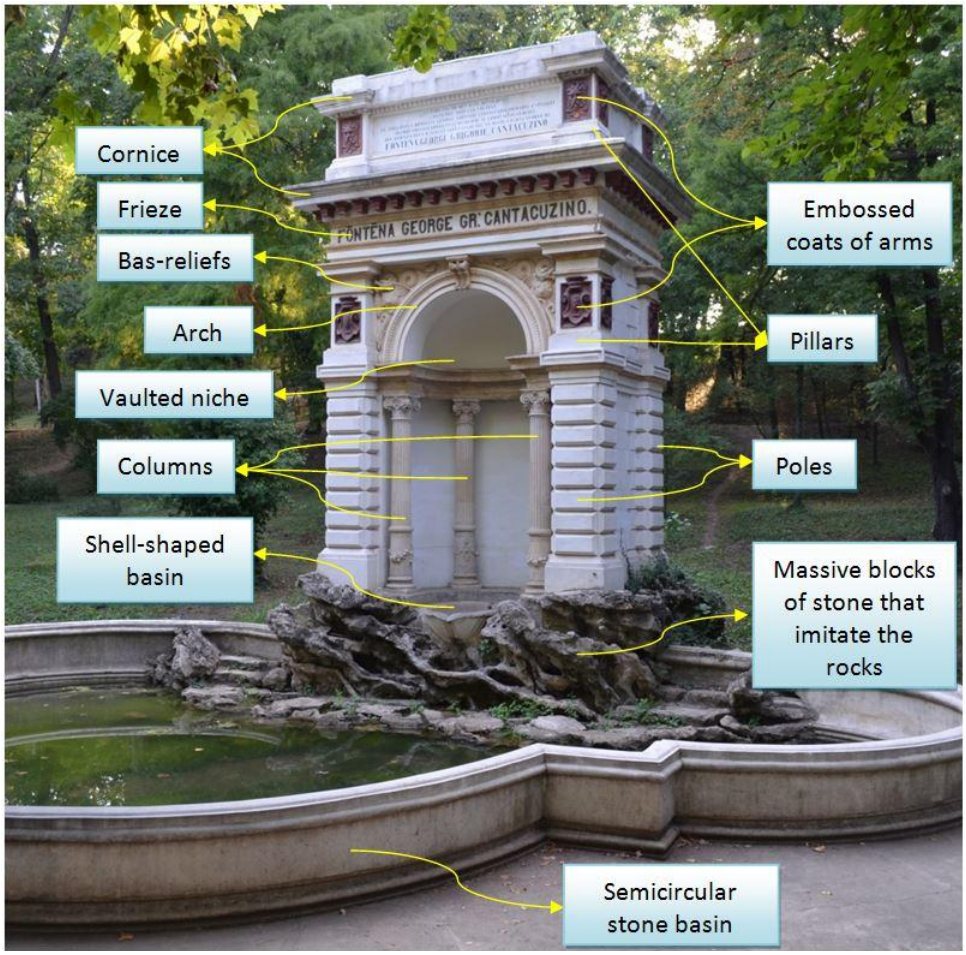

Fig. 1. Semantic annotation of segmented objects in the model

A description of the semantic notation has been made, as can be seen below.
Embossed coat of arms are part of the pillars.
The pillars rest on the poles.
The cornice is part of the building.
The frieze is part of the building.
Bas-reliefs are part of the building.
The arcade is part of the building.
The vaulted niche is part of the building.
The vaulted niche rests on the columns.
The columns are part of the building.
The basin is at the base of the building.
The massive stone blocks that imitate the rocks are part of the monument.
The semi-circular stone basin is part of the monument.

The building is part of the monument.

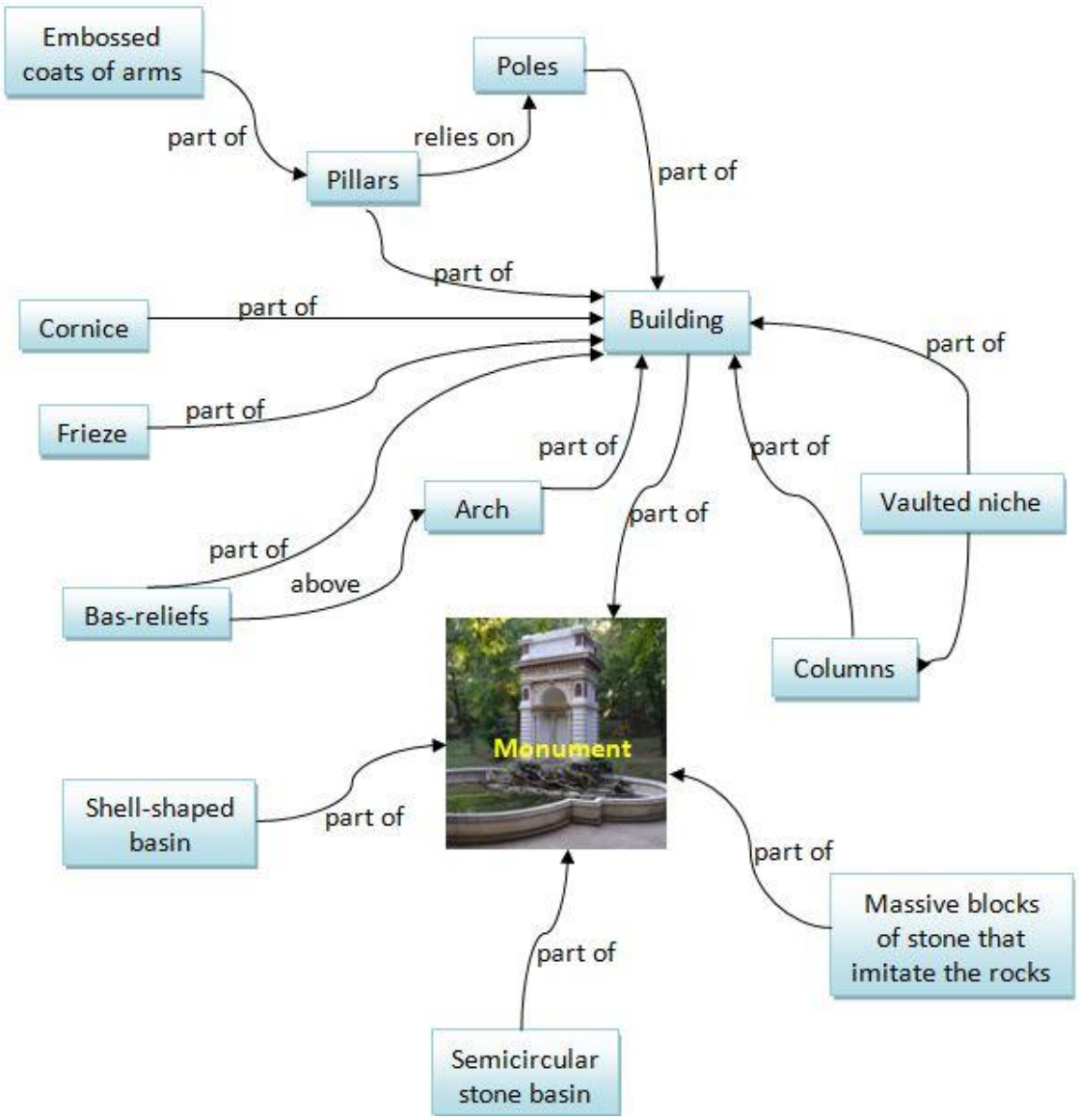

Fig. 2. Semantic annotation using ontology

But is information about a building related only to the architectural side? No way. When we talk about a historical building, we bring much more information about that building, such as information about the history of the place and the building, information about its structure, legal status and so on.

It turns out that for a building, multiple ontologies can be created for each domain that describes that building, which contains information about that building.

3. Improving Semantic Modeling with the help of Augmented Reality

In order to create a semantic modeling that has a unitary structure for all geometrically modeled buildings, regardless of who makes this model, it was proposed in this article to create an application based on augmented reality to help semantic modeling of historical buildings on the architectural side. This will support all those who make 3D models of

buildings belonging to the cultural heritage, but not only them, because a limited number of people have a thorough knowledge of architecture.

This app shows rich image-based add-ons. The application will have to contain a library with several well-structured images to recognize in reality and to add multiple annotations related to those images.

By using a portable device (smartphone, tablet) that has the application installed, it recognizes certain architectural details and displays data about them in real time, as seen in the figure below.

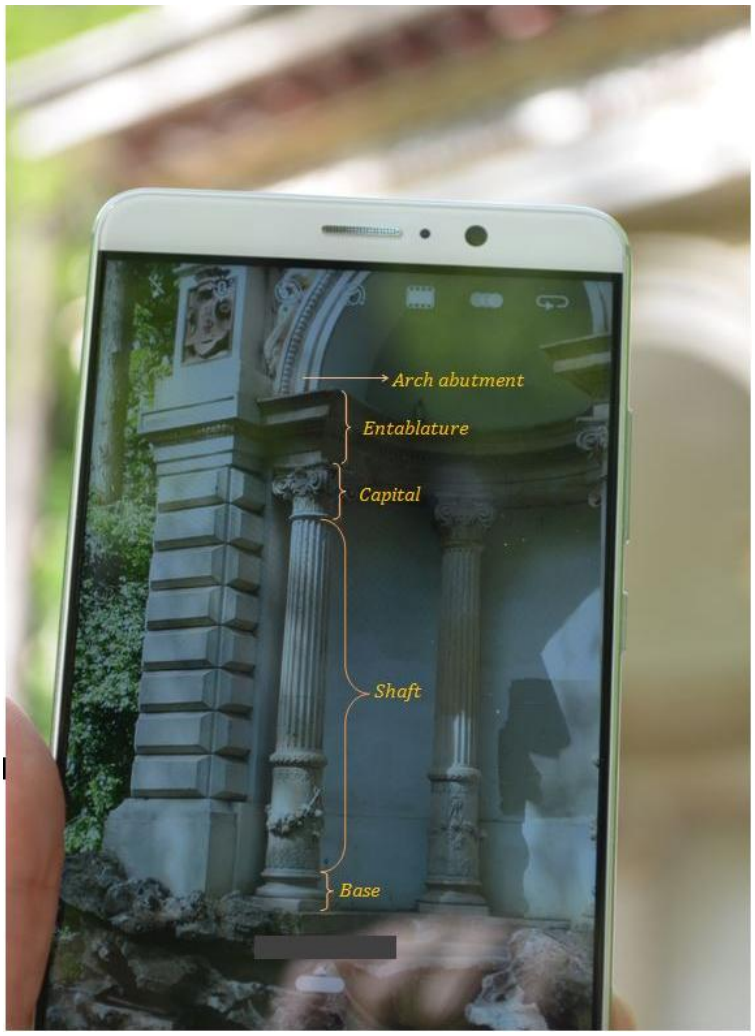

Fig. 3. The proposed method

As we see in the figure 3, the application identifies the type of column in the image, which can be Doric, Ionic, Corinthian or Composite (a combination of the Ionic and Corinthian style, which can be considered the most harmonious and richest) and applies annotations on the image, in real time. In this work, a column from the four columns of the historical fountain George Cantacuzino from Carol Park, Bucharest was taken as a model. These columns are part of the composite type (a combination of the Ionic and Corinthian style), which is slimmer than the Corinthian and can be made with all its elements, except the capital.

If in figure 3, where the entire column can be seen, the notations are as a whole, in Figures 4 and 5, where zoom in has been made and only parts of the column can be seen, the notations are detailed.

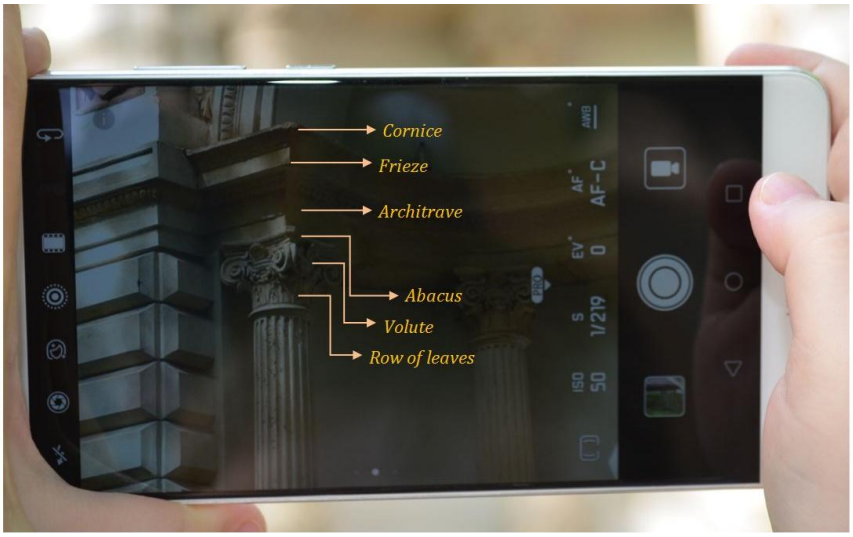

Fig. 4. Zoom in

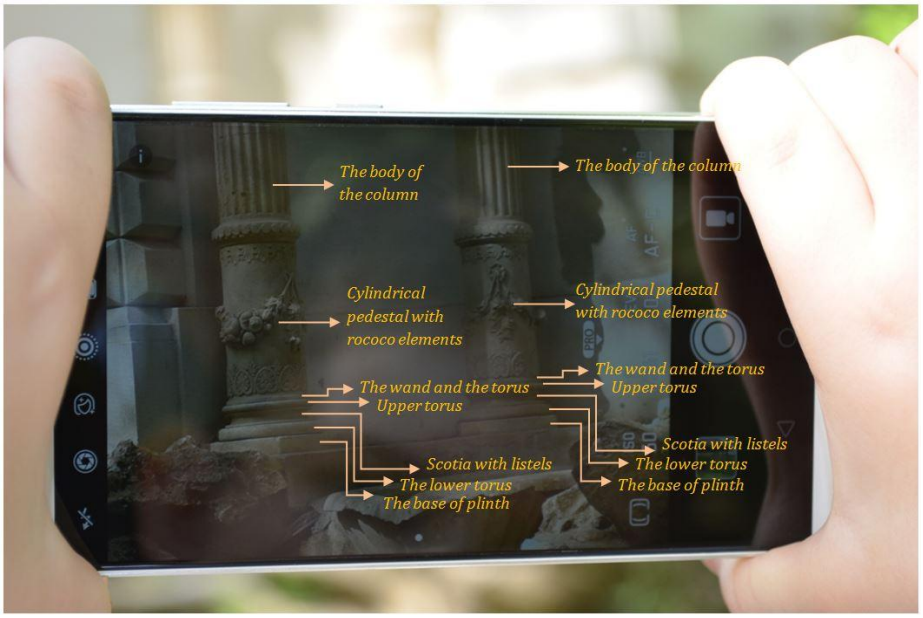

Fig. 5. Zoom in (more details)

What is the benefit of such an application? Many 3D models of buildings belonging to the cultural heritage are generally made by companies only on the basis of the 3D geometric model, using either laser scanner or digital images. But how many of those who make the geometric model also add semantic notions or have sound architectural notions? Very few. The application helps by applying annotations that have the same structure for all buildings.

4. Conclusions

The advantage of the application-program presented in this article is the use of the same ontological structure by all those who make the geometric model of the buildings or the subsequent application of this structure to the geometric modeling.

When several important buildings have been modeled using the same unitary structure, they can be represented in a semantic Web.

In conclusion, the application program that is proposed to be developed brings a major benefit for the future modeling of the buildings, this benefit resulting from the supplementation of additional, complete information and with the same structure for all the buildings, regardless of the person making the model. The processing of information within a semantic web is possible only when they are all represented semantically.

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