

# Alternative Tourism – an Ontology of Bulgarian National Revival Residential Architecture for the Purposes of an Intelligent Tourist Guide

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**Abstract.** In the article, we will explain the concept of alternative tourism and its subtypes, we will dwell on its role in the preservation of cultural and historical heritage of an architectural type by means of technological solutions – an intelligent guide with ontological knowledge.

**Keywords:** Bulgarian National Revival Residential Architecture, Alternative Tourism, Tourist Guide, Ontology.

## 1 Introduction

Bulgarian National Revival House (traditional residential architecture in and around the Bulgarian National Revival Period; for instance a popular house, accessible with virtual tour, is (Ethnograph.info, n.d.)) has many development paths for alternative tourism. For instance, restoration and repurposing into a restaurant, tavern, hotel, museum, artistic centre, and others. The services that could be offered also vary: photo sessions with traditional costumes for visitors; maintaining the old crafts (in workshops), making souvenirs or selling those made by disadvantaged people; educational tours for architecture and construction students to capture and examine techniques/constructions of the *old masters*. Also, the small settlements and almost depopulated villages can develop rural tourism – animal husbandry, agricultural activities.

But in parallel with the striving for an environmentally friendly way of life, the digital presence is also developing, expanding the possibilities for alternative tourism, with the positives: minimal environmental and site footprint, easy information discovery, possibility of access from almost all parts of the world and also for disadvantaged users, digital preservation of buildings that no longer exist; conclusions based on the defined

knowledge, educational games with questions and answers, popularization and personalized visit based on route, interests, time optimization, weather conditions and more. If we digitize a building that is about to collapse, at a future stage we could, based on the collected information about it, recreate its *copy* – digital or physical. Domain knowledge and its correct interpretation are the basis of any development, including ontologies for a *Tourist Guide (TG)* application. In this context, an ontology of Bulgarian National Revival houses was developed for the purposes of an intelligent *TG*, described in Madanska et al. (2021a), Madanska et al. (2021b), Madanska (2022a), Madanska (2023) and others.

An initial version of the article was published in (Madanska, 2022b), and in the present report, we will pay attention to the integration of the ontology for Bulgarian Revival Houses with others representing tangible and intangible cultural and historical heritage. The basic idea is to expand the knowledge of the *TG*, which will inevitably increase the possible routes it could generate.

## 2 Alternative Tourism

According to Triarchi & Karamanis (2016), alternative tourism arose between the 70s and the beginning of the 80s of the 20th century, as an alternative to established mass tourism. It aims to preserve natural features with a priority of rural regions, offering exploring activities for tourists and at the same time development of the environment (Triarchi & Karamanis, 2016). Triarchi & Karamanis (2016) review definitions and statements about alternative tourism, concluding that there is no accurate definition, but different interpretations exist. Bulgarian Association for Alternative Tourism (BAAT)'s definition is: “*The alternative forms of tourism combine tourist products or separate tourist services, different from the mass tourism by means of supply, organization and the human resource involved. These are rural, ecotourism, adventure (biking, horseback riding, snowshoeing, ski mountaineering, rafting, diving, caving, climbing), thematic tourism – connected with the cultural and historical heritage, the esoteric, religion, wine, traditional cuisine, ethnography and traditional music and handicrafts.* (BAAT's Statute) (BAAT, n.d.)”.

### 2.1 Types

“Pursuant to Art. 16, paragraph 1 of the Tourism Act (TA), with Order No. T-RD-16-103/11.03.2015, the Minister of Tourism approved the Concept for Tourist Zoning of Bulgaria” citing <https://tourism.government.bg/bg/kategorii/strategicheski-dokumenti/koncepciya-za-turistichesko-rayonirane-na-bulgariya>, in which *Concept*, a classification of the main tourism types and their subtypes (<https://tourism.government.bg/sites/tourism.government.bg/files/uploads/raionirane/koncepcia.pdf>, pp 29-30) is developed, as mentioned there: by using “*officially accepted and market-imposed definitions on a global scale*“ for the employment of an uniform terminology when distinguishing the types of tourism, adapted to the Bulgarian reality. The fact that “*like any classification, this one is to some extent conditional*” is

pointed out and is based on the criteria: “*motivation for undertaking a trip, type of tourist activity and environment for its practice*” (Ministry of Tourism, Republic of Bulgaria, 2015). According to the *Concept’s* document (<https://tourism.government.bg/sites/tourism.government.bg/files/uploads/raionirane/koncepcia.pdf>, pp 29-30), the main types of tourism are: sea, mountain, adventure and ecotourism, health, rural, cultural, religious and pilgrimage, wine and culinary, urban entertainment and shopping, business, sports and cruise. Many of these types are alternatives to mass tourism.

Due to the many specialized areas, various classifications and frameworks of description arise in the scientific community. Vasileva (2007) presents a list of main types of alternative tourism and their variations, and concludes that in many cases, in practice, they are intertwined and there are no clear boundaries between them.

Digital tourism belongs to the alternative types. In Karadzhev et al. (2021) it is interpreted that the concept includes different variations, but they have common features – the *travel* is by means of a computer/mobile device, sometimes also additional devices, such as Virtual Reality glasses for a more realistic experience. In Todorova-Hamdan & Hadzhikolev (2021) a classification of Information and Communications Technology (ICT) in tourism is presented, as well as “*positive and weak sides of Bulgaria compared to world practice*”.

The term *intelligent tourism* is now relevant. The European Commission also emphasized it by announcing the competition *European Capital of Smart Tourism for 2024* (European Commission, 2023), highlighting that it should be accessible, sustainable, digital, with a cultural and creative spirit.

## **2.2 A State-of-the-Art Review**

There are attempts to transform traditional architecture, including Revival architecture, into a tourist site; as well as including ICT to its appearance. In addition, there are numerous tourism applications, but few are based on ontology. Some possible reasons are: creating an ontology requires consultations with specialists in the field of interest and knowhow in semantic modelling, also it takes a long time of information preparing, ontology design and developing. But the use of ontology contributes to the better functioning of the data in the applications, due to the semantic representation. Information is described semantically in an ontology and becomes comprehensible to machines (agents) and humans in the same way. Moreover, adherence to established standards in cultural heritage, such as *Cataloging Cultural Objects (CCO)* (Baca et al., 2006), ensures consistency and interoperability in managing and sharing heritage information across different platforms and institutions.

### **2.2.1 Abroad**

In (Yeğin, 2022), the Divriği settlement is discussed, with its buildings from the Seljuk living house typology – usually a two-story house, between its front facade and the street there is a wall, and behind it a large garden. Yeğin claims that “*Divriği Municipality and District Governorate have organized joint summer schools and workshops*

with universities ... and have prepared re-functional and utilization projects” of some buildings. The restoration project of the Sancaktar mansion has been prepared to be a children's library, while this of the Ayanaga mansion – a culture house, Ercokluzade Yusuf mansion – a guest house (Yeğin, 2022). In Yeğin (2022), traditional houses adapted for cultural tourism are presented. There are also natural obstacles to the preservation of architectural heritage, and other negative factors – human interventions, vegetation cover, pollution, writing on the walls, etc., such a theory is considered in Erginal & Uludağ (2018), where the authors discuss Aya Nicholas monastery, Kıyıköy castle walls and historical houses. Pai et al. (2019) focus on the ontology-based tourist knowledge representation and recommendation method with the help of online travel reviews, using the current location of the tourist, thus decision making is easier. Knowledge-based system using ontology about heritage buildings is introduced in Tiano et al. (2019).

### 2.2.2 In Bulgaria

There are many examples of sites in the alternative tourism sector. To illustrate, the Kordopulova house and the House of Kuyumzdhioglu, which are also individuals in the presented in the article ontology. The Kordopulova house in Melnik stands out with a long history, exquisite architecture, traditions in winemaking. But the region is remote and needs to offer a *package* of services to promote it. For example, the website of the Kordopulova house (Kordopulova-house, n.d.) advertises the so-called *living wine* and it is announced that the production offered by them is based on a technology from nearly 300 years ago, which can „be tried in the cellar of the largest Revival house on the Balkan Peninsula”. Certainly, its inclusion in the *100 Tourist Sites of Bulgaria* (<https://btsbg.org/nacionalni-dvizheniya/100-nacionalni-turisticheski-obekta>) further favours the development of tourism. While at the Regional Ethnographic museum - Plovdiv, housed in the house that belonged to Argir Kuyumzdhioglu, approaches such as: an audio walk (Institute of Mathematics and Informatics, Bulgarian Academy of Sciences, 2020) and a virtual walk (Ethnograph.info, n.d.) were used. Such projects enable disadvantaged people to *visit* the museum and get a tourist experience.

An example of innovation is Varna with several developed mobile tourism applications and services, as described in Patarinski (2021). Patarinski claims that private Varna start-up companies are entering the market with products such as *iLoveBulgaria*, *VarnaCityCard*, etc., which using ICT “integrate the elements of the overall tourist product of Varna” – a game approach has been applied, stimulating the collection of points and a subsequent reward, a combo card is also used as a “*complex service for museums, tours, restaurants, shops, etc.*” (Patarinski, 2021).

Motivated by the experience of scientists in Bulgaria and abroad, we believe that alternative tourism provides an incentive for the restoration of buildings that would otherwise turn into ruins, and the key to both physical and formal preservation is the use of digital technologies – generating of routes, personal approach to the tourist, visit with educational games, distant visualization and others.

### 3 Intelligent Tourist Guide

The *Tourist Guide* is also an example of application in the context of alternative tourism. The architecture of the application is discussed in (Glushkova et al., 2019; Stoyanov et al., 2019), and continues to be further developed and supplemented with new areas of interest. The modules of TG are being worked on, but there is no finished application yet. TG is designed to work in three modes – virtual, real and mixed. As a mobile application (Kostadinov et al., 2022), it applies a survey, for initial research of the tourist and based on his preferences, interests, time range that he can allocate for the particular trip, weather conditions and others, it provides possible routes. An interesting and important functionality is that TG generates a route of interests, as a virtual one, for the tourist to examine and explore, regardless of his physical characteristics. If the tourist is interested in revival architecture, the agents should access and extract the knowledge from the ontologies for this domain.

One of the main differences of TG from other touristic applications is precisely the use of a hierarchy of ontologies for representing cultural and historical objects, called *Cultural and Historical Heritage-Ontology Network (CHH-OntoNet)*, developed based on *CCO* standard (Baca et al., 2006). The use of this standard *has deep roots* in our team (Trendafilova, 2007). The ontology development is a long-term process, and different persons work on different areas of interest, that is, the work is distributed – there are several ontologies. But ontologies should work in the same application, that is, they need to have common points (the use of a standard). Also, the reasoning process is faster when working with separate ontologies rather than one that holds all the data. If necessary, Protégé provides the possibility to merge them, or *import* them in one, and then run queries. Each request of the tourist, the TG processes by traversing the hierarchy of ontologies.

Fig. 1 illustrates SPARQL query with several axioms related to Rhodope houses, that a potential tourist might be interested in. Their individuals – with location, building number, purpose and condition are presented (Fig. 1); and most of the data is according to KAIS – Portal for electronic administrative services /Geodesy, cartography and cadastre agency, Republic of Bulgaria/ (KAIS, n.d.), but there is also authors' opinion from visiting the objects.

```

SELECT DISTINCT ?house ?location ?building_number ?purpose ?condition ?address
WHERE {
  ?house a rhodopeHouse .
  ?location ois:LocatedIn ?location .
  ?location ois:LocatedIn ?street .
  ?street ois:LocatedIn ?somewhere .
  FILTER (?somewhere = I:SmolyanMunicipality || ?somewhere = I:SmolyanTown ) .
  ?house ois:LocatedIn ?location .
  FILTER NOT EXISTS { ?location a I:BuildingNumber . }
  ?house hasBuildingNumber ?building_number .
  ?house purpose ?purpose .
  ?house condition ?condition .
  ?house address ?address .
}

```

house	location	building_number	purpose	condition	address
Згровски коняк	ул. Кръсто Гайдев 4	83274.501.670.1	"Сграда - паметник на културата"@bg	"Общинска публична собственост, отворена за посетители, в добро състояние"@bg	"с. Шпока пъка, п.к. 4710
Хаджичонева къща	ул. Момчил коняк 8	67653.925.118.1	"Друг вид сграда за обитаване"@bg	"Общинска публична собственост, отворена за посещение и поддръжана (свр.Родопски хайдуци)"@bg	"гр. Смолян, п.к. 4700, ул. I
Пангалова къща	ул. Родопи 85	67653.920.326.1	"Сграда за култура и изкуство"@bg	"Частна собственост, затворена за посетители, недобро състояние на сградата"@bg	"гр. Смолян, п.к. 4700, ул. I

Fig. 1. SPARQL query resulting some axioms about Rhodope houses.

It is important to note that the hierarchy of ontologies is easily extended with ontologies of cultural and historical objects that can be described with the *CCO* standard – those

that refer to tangible cultural and historical heritage (CHH) (Madanska, 2023). This is because the ontologies are developed according to the CCO standard and have an almost identical structure. The main problem that arises is when we want to add ontologies that are not related to tangible CHH, but to natural objects or intangible CHH – such as folklore, folk dances or customs – whose characteristics do not fully meet the standard. For their digitization in the form of ontologies and their inclusion in *CHH-OntoNet*, we have decided to use parts of the CCO standard by defining additional authorities and work records (Baca et al., 2006), that are appropriate for the specific object – in this way we will make an extension of the standard with additional elements in the form of authorities and work records. Authorities definitely are some of the most important parts of the standard. They serve as vocabularies, which contain the most important terminology, used for various cultural sites description. These vocabularies are grouped by themes and there are four covered by the standard: *Personal and Corporate Name Authority*, *Geographic Place Authority*, *Concept Authority* and *Subject Authority*. Another important element of the CCO standard are the *work records*. They present all different types of individuals, which will be documented and described in the standard. Here, for example, old houses, traditional folk costumes, folk dances, natural attractions, etc. can be defined.

Intangible CHH is part of a nation's uniqueness and culture, and plays an important role in its identity and self-awareness. We think that the digitization of the intangible heritage by means of ontologies, along with the tangible, can give a much more accurate and clear picture of the appearance and identity of a people. Therefore, it is important to include it as part of the various methods of alternative tourism, where along with material objects, information is also presented about the immaterial (spiritual), which is also the basis of many of the architectural monuments of culture. When building an extension concept, there is an idea of the scope of TG's knowledge. Therefore, we also take into account the intention to subsequently include intangible and natural heritage.

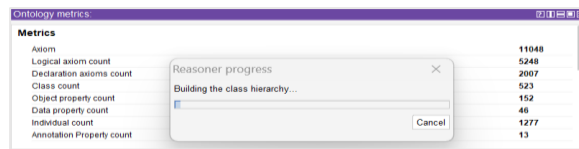
In the next part of the article, the idea of unifying ontologies that describe cultural and historical objects using the CCO standard will be presented. We will also present an idea to develop a meta-ontology to represent knowledge at a higher abstract level, which will facilitate the process of searching and extracting knowledge from *CHH-OntoNet*.

#### **4 Extension of CHH-OntoNet with an Ontology of Bulgarian Revival Residential Architecture**

Ontology engineering is an appropriate approach to systematize knowledge that can be reused, extended, and modified. Domain *Revival residential architecture* includes numerous interior and exterior elements, features, constructions, materials and techniques, cadastral features, functionality of rooms, and other details, which in Semantic Modelling should be affected, using the experience of subject matter experts. And they also have indirect points of contact with other areas of interest – persons, organizations, events, periods related to the houses, etc. They are discussed in detail (Madanska, 2023). These features are not easy to formally represent. However, with greater detail,

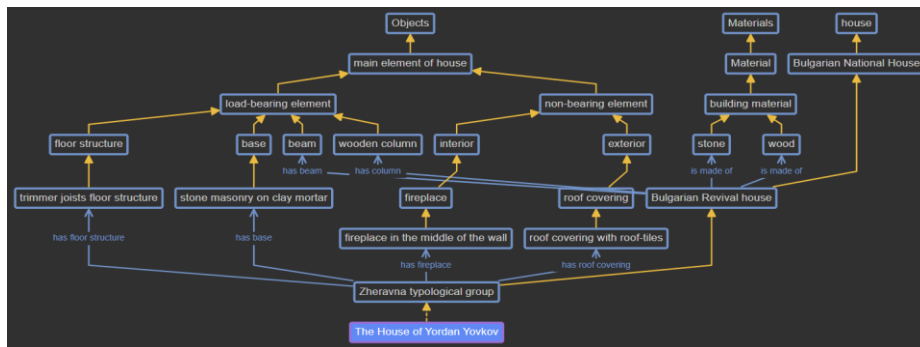
a broader range of knowledge is assumed for the intelligent agents, that will provide personalized service to the user in the TG developed by an extended team of scientists.

The network of ontologies for the Bulgarian National Revival residential buildings, like the others in *CHH-OntoNet*, is created using *Protégé* (Musen, 2015). It contains the metrics from Fig. 2, which continue to grow – including *OldHouses*, *Agents*, *Objects*, *Materials*, *Subjects*, *Functionalities*, *Locations*, and the newly created *Views ontology* (describing images, as presented in Madanska (2023)), which is under development. The starting reasoning process (as a data verification method) shows that no inconsistencies are inferred.



**Fig. 2.** Ontology metrics (Protégé) – the ontologies for Bulgarian National Revival houses.

The house description template can be used in future developments on the topic because a knowledge base has been created for the domain. In Fig. 3 (according to Stamov (1989), Stamov (2007) and Stamov (2016)) a basic concept for the description of a Zheravna Revival house is presented, but beyond it there are many more details that are not included for easier understanding of the scheme.



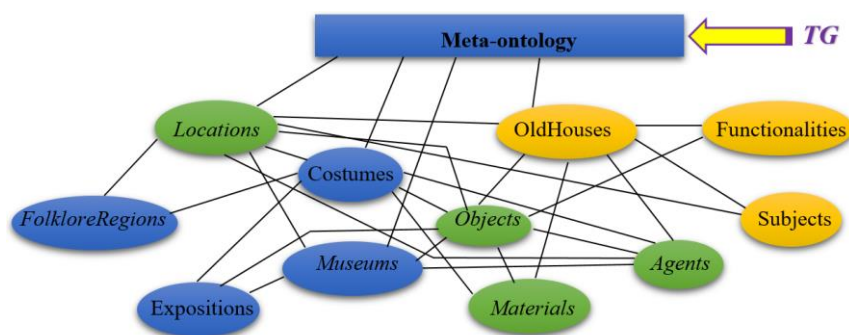
**Fig. 3.** Web-Protégé entity graph – a brief illustration of axioms about a house.

The idea of unifying ontologies in *CHH-OntoNet* could be implemented in at least two ways: 1) at the element level – respectively identical names of classes/ontologies/properties, in different approaches, e.g.: a) by adding additional axioms, as such for equivalence; b) or general merging of some ontologies, e.g. *Locations* even with full overlap of *Internationalized Resource Identifier (IRI)* of elements; 2) at a higher level – expanding the *Meta-ontology* with the necessary axioms and direct distribution of the search among the remaining subdomains of CHH. A combination of both solutions is also possible. E.g., integration of the domain-specific ontologies that correspond to CCO

authorities (*Materials*, *Agents*, etc.) into a common ontology, while preserving specificity. Thus, in the merged *Materials* there may exist, for instance, a *Material* class with subclasses: *BuildingMaterial*, *TailorsMaterial*, etc.

*Meta-ontology* (with an initial version developed, and described partly in Glushkova et al. (2018) includes *ObjectName* class with individuals, such as *Costumes*. Individuals are defined analogously using a property *isPartOfOntology* connected to the *IRI* of the relevant ontology. We incorporated the concept of National Revival houses (by creating an individual) and connecting it through property to relevant *IRI* of ontology. Further experimentation with the agent module of the search process validation project is required. We believe that the process can be optimized by merging concepts due to the CCO standard-based structure (Baca et al., 2006) – ontologies: *Objects*, *Materials* (Concept Authority), *Locations* (Geographic Place Authority), *Agents* (Personal and Corporate Name Authority); or properties, such as *isLocatedIn*. Such experiments are forthcoming and their results will be tracked.

Let's look at a conceptual scenario. In Fig. 4, there is a schematic variant of extension of the *CHH-OntoNet*. The ontologies that are depicted in green are repeating by name and have some common elements. The blue ones (including the overlapping ones in green) are ontologies which are developed by Mariya Miteva (Glushkova et al., 2018) in the *CHH's* subdomain traditional costumes. The ontologies *OldHouses*, *Functionalities*, *Agents*, *Subjects*, *Objects*, *Materials* and *Locations* are part of a doctoral dissertation (Madanska, 2023). The main reason for this is the CCO standard using. We think that if two or more ontologies are describing similar elements – materials, agents, etc., then they could be integrated without strong changes, e.g. with a *meta-class* (upper level class) as their parent.



**Fig. 4.** A variant of extension of CHH-OntoNet.

Another case of interest is some of the houses have been redeveloped and organized as museums – this is also modelled in the ontologies from the domain of interest National Revival houses, in the form of specific individuals. It is possible for a museum organization to move its location, and this is a good reason not to make equivalents – ‘a revival house’ and that ‘it houses a museum’. The *Museums ontology* also includes individuals of specific museums (that is, a given costume is located in an given exposition and museum) (Glushkova et al., 2018). Therefore, these two individuals could be described



by axioms of equivalence, or by using only one of both *IRI* in the whole project. The same approach could have been applied to individuals that are from sets such as persons or organizations. Because the same person/organization may have a role in more than one area of interest.

There are many elements that need to be decided. This is an open-ended topic. Many ideas are under discussion, and experiments are needed.

## 5 Conclusions

The ontologies from the CHH's subdomain Revival residential architecture include the largest set of axioms and individuals compared to the other ontologies developed for the intelligent *TG* project. We continue to claim that we are innovators in the field of ontological engineering in the formal presentation of Revival architecture in Bulgaria (Madanska et al., 2021a), but the work on the main project has not been finalized. However, we have a knowledge base that can be used to extract knowledge of a different nature that could be interesting to the tourist, but we should work for the integration with the other ontologies in *CHH-OntoNet*. The process is laborious, but as a result, indirectly leads to smarter solutions for alternative tourism. The developed ontological network could also be used in e-learning (Cholakov, 2020; Cholakov, 2021; Stoyanova-Doycheva et al., 2022).

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