The Digital Infrastructure for Knowledge Based Tourism: Building Ontology Concept by XML Schema Definition and Extensible Markup Language

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ABSTRACT

Tourism is a strategy for country to increase its income. Digital technologies are currently used to help improve tourism, for example with information about tourist areas through the website or Mobile Apps. Database is required as the basic infrastructure for implementing system when to support tourism In this research, we discussed about the database model that can stored tourism data. Tourism databases such as warehouses are rich in information about tourism. Tourism information can be in the structured or unstructured form. Database development is an important part of enhancing development supported by digital technology. In this research, ontology is applied for database development and it produce the ontologies that could be utilized for tourism. In this research, ontology is applied for database development and it produces the ontologies that could be utilized for gastronomic tourism.

KEYWORDS: *database, digital technology, ontology, tourism, XML Schema Definition, Extensible Markup Language*

INTRODUCTION

Tourism has historically been dependent on the character of the destination, including attractions, beaches and resorts. It is a complex activity that requires the availability of certain parameters (e.g. accessible road networks, standard accommodation facilities, attractions etc) and information on potential and existing attraction sites. Information on these parameters and attraction sites can be gathered, processed, organized and stored using tools such as Global Positioning System (GPS), Geographic Information System (GIS) coupled with remote sensing. After gathering the needed data about a destination, the data must be stored in a retrievable form to enhance tourism, and this can be achieved with the aid of GIS.

To reach the rapidly changing technology speed in 21st century is a big issue of today in any country's government system. Tourism is a sector where millions of people exchange their money to get high quality service and the number of tourists depends on how the service will be delivered. The tourism sector is one sector that provides income for the country. According to Popescu et.al. (2015) many countries make the tourism sector to be their main income [1].

Tourism is what involves every human being in the world. Tourists need detailed information about each place that they want to visit. These information needs include: [2]

➢ Location of tourist attractions, and also the weather
➢ Transportation, lodging, restaurants, souvenir shops
➢ Local customs
➢ Good season to make a visit

➢ Types of objects that can be visited
➢ The beauty of the tourist attractions

Today we can see hundreds of digital resources which provide huge range of data in order to inform people about the place, the way, the service and the prices of a place where they will visit and spend their money.

The global importance of tourism is steadily rising, creating new job opportunities in many countries. Today's information management solutions for the complex tasks of tourism intermediaries are still at an early stage from a semantic point of view. The tourism product has an intangible nature in that a prospective traveler cannot touch the product before the trip. This is one major reason why information about tourism and travel services (e.g. destination, hotel, restaurants, events, transportation etc.) must be accurate and credible, one that fosters users' confidence.[2] One way to achieve this level of credibility is to engage knowledge representation formalisms that can sufficiently capture all relevant facts about tourism objects in a domain on which approaches to rendering tourism information services can be based. An ideal approach to achieve this is the use of ontologies which provide the platform on which recommendation formalisms that exploit deep knowledge of the user, tourism objects, and other relevant contextual information that closely model reality can be built. [2]

As competition between tourism destinations increases, local culture is becoming an increasingly important source of new products and activities to attract and amuse tourists. Gastronomy has a particularly important role to play in this, not only because food is central to the tourist experience, but also because gastronomy has become an important source of identity formation in postmodern societies. More and more, 'we are what we eat', not just in the physical sense, but also because we identify with certain types of cuisine that we encounter on holiday.

As tourists become more mobile, so does the food they eat. The comfortable association of certain foods with certain regions is being challenged by the growing mobility of food, culinary styles and the increasing de-differentiation of dishes and cuisines. Far from producing an homogenized gastronomic landscape, the tension between globalization and localization is producing ever more variations. [3]

The aim of this research is to build database based on ontology for gastronomic tourism in Uzbekistan, especially in Bukhara region.

The research objectives are as follow:
➢ Develop ontology for database of gastronomic tourism of Bukhara region

➢ Create XML Schema Definition (XSD)
➢ Create Extensible Markup Language (XML)

Database with ontology concept is a start point of any issue whether economic or technological sphere. Touristic product is a thing which cannot be touchable or seen till you receive all services and feel the real quality of that. In 2019 near the 5 million people visit Uzbekistan in terms of travel and business including local and international tourists. Depending upon the potential of country this number is not high.

LITERATURE REVIEW

Over recent decades, gastronomy tourism has gone beyond the table setting and now includes all sectors of a destination's food and tourism chain – producers (agriculture, fishing, etc.), processing firms (dairies, olive mills, canning plants, wineries, etc.), the tourism and hospitality sector (restaurants, specialised accommodation, gastronomic activity firms, etc.), the retail sector, the commerce sector (sale of products) and even the knowledge sector.

With a view to the publication of the Global Report on Food Tourism, a survey was conducted among the UNWTO AFFILIATE Members in order to know their opinion about current situation of Food Tourism. Responses form Affiliate Members, working in diverse sectors around the world, were received in this regard.[4]

According to the results this survey, 88.2% of respondents consider that gastronomy is a strategic element in defining the brand and image of their destination. Only 11.8% were of the opinion that gastronomy plays a minor role

Digital technologies have brought significant transformation to the tourism industry, revolutionising tourism enterprises, products and experiences, business ecosystems, and destinations. Digitalisation has also transformed the traditional roles of tourism producers and consumers, with new roles, relationships, business models, and competencies emerging. The rise of digital platforms has increased the variety and volume of tourism products, services and experiences, with on-demand functionality accelerating the speed of economic transactions, market awareness and feedback. Digitalisation leverages digital technologies and data to transform businesses and business ecosystems. It transforms markets and production processes, and has significant implications for economic and social organisation, innovation, and competitiveness. [5]

Tourism cannot thrive without accurate and reliable information about a destination which will be the

main element that will draw tourists/visitors. A visitor cannot visit a place without information about.

In 2018 more than 5 million people visited Uzbekistan, and this number is twice as much than 2016 from 2 690. million. 6 748. Million tourists came to the republic during 2019 and it was more than 26.2 % comparing to 2018. [6]
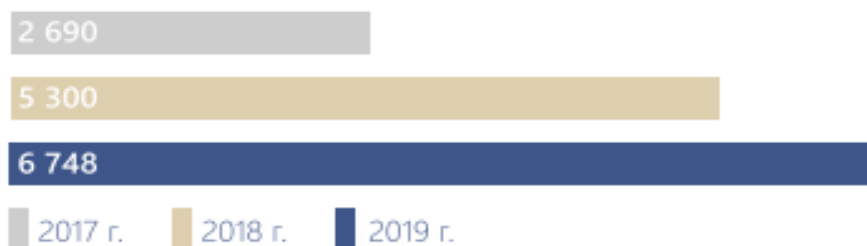
Figure 1. Number of tourists in Uzbekistan during 2017-2019 (mln people).

The most number of visitors from Russian Federation and European countries hold the last places according to Figure 3.

Страна	2018 г.	2019 г.
Russian Federation	371,5	455,7
Turkey	41,2	63,5
Afganistan	44,2	62,5
China	32,4	54,2
Korea	27,2	35,5
India	21,0	27,8
Germany	18,0	27,6
Japan	17,0	24,9
Italy	13,8	20,3
France	13,5	20,3

Table 1. List of countries people come from

The State Committee for the Development of Tourism and the Association of Cooks of Uzbekistan jointly implement several projects in this direction. On December 12, in the framework of the project "Gastronomic Tours of Uzbekistan", courses on "Hospitality Schools" were held in several districts of Tashkent.

Management data of tourism can be done by developed database and using ontology concept. The use of ontology is able to integrate heterogeneous schemes in various domains. A number of frameworks designed using an ontology-based integration approach have developed in recent years and provide many benefits.

In building ontology concept there are 7 main steps, which are:

Step 1. Determine the domain and scope of the ontology

Step 2. Consider reusing existing ontologies

Step 3. Enumerate important terms in the ontology

Step 4. Define the classes and the class hierarchy

Step 5. Define the properties of classes—slots

Step 6. Define the facets of the slots

Step 7. Create instances [7]

Tourism has historically been dependent on the character of the destination, including attractions, beaches and resorts. It is a complex activity that requires the availability of certain parameters (e.g. accessible road networks, standard accommodation facilities, attractions etc) and information on potential and existing attraction sites. Information on these parameters and attraction sites can be gathered, processed, organized and stored using tools such as Global Positioning System (GPS), Geographic Information System (GIS) coupled with remote sensing.

After gathering the needed data about a destination, the data must be stored in a retrievable form to enhance tourism, and this can be achieved with the aid of GIS.
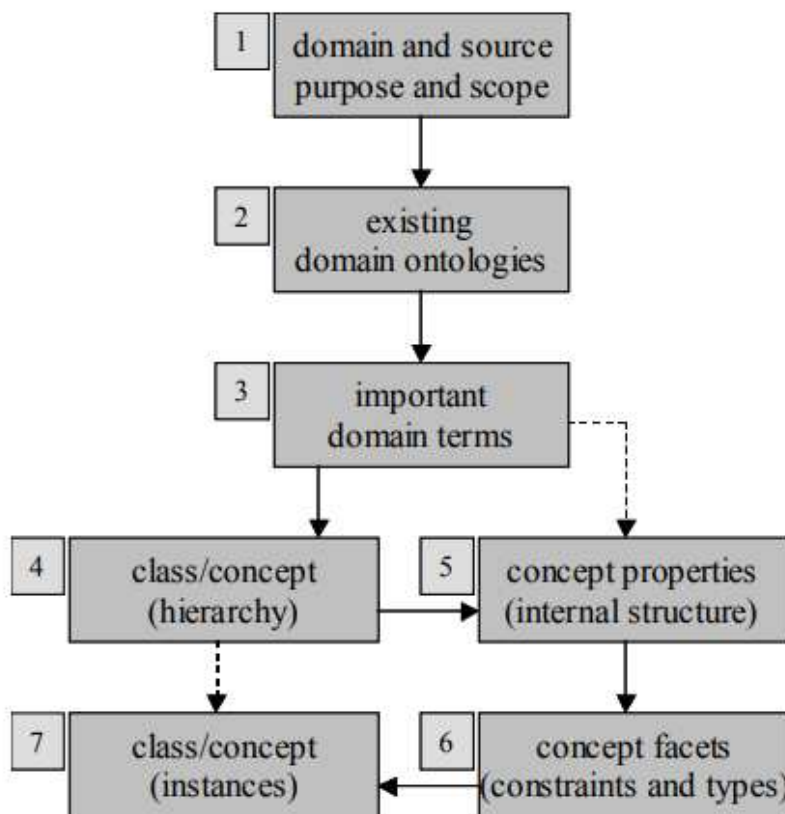

Figure 2. Ontology development process

The problem with information aggregation is that the information is not structured in the same manner. Each data source, or application, has a different data representation and provides different data formats for integration. HTML, XML, flat files, relational model are some of examples that we can find in an aggregation problem. Another problem is the semantic differences between data sources. We can find the same word with different meanings. For example, in one data source, customer can refer to the tourists in others it can refer to the travel agencies. [8]

Ontology provides a rich and predetermined vocabulary that functions as a conceptual interface that is stable and does not depend on data schemes; knowledge represented by ontology is comprehensive enough to support the translation of all relevant information sources; ontology supports consistent management and recognizes inconsistent data. [7]

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RESEARCH METHODOLOGY

This research discusses the concept to build database based on ontology for data of tourism in Uzbekistan. Five steps in this research are:

1. **State of the art,** this step includes the way of building ontology concept and the articles which were used to make this research.

2. **Data Collection,** contains what types of data we collected in this research and the ways to collect number of tables.

3. **Develop the Ontology,** this step shows building ontologies for gastronomy.

4. **Develop XSD**, this step is also known as the framework, schema, or the table is usually referred to as a field. Develop XSD is made to make visible the connection between the data and to define the block structure of XML documents.

5. **Develop XML**, this step is based on a framework XSD document that has been done, using special tags to declaring the version of XML, the attribute that contains information of the object, and elements that describe the object.

ANALYSIS AND RESULTS

The country of Uzbekistan is a country rich in culture which makes it a beautiful country as a tourist destination. Many ways are carried out by the government of Uzbekistan to improve the tourism sector, such as establishing collaboration with other countries, provide information in websites about Uzbekistan, promoting the tourism sector through online media.

Data Collection In order to build the ontology in this research we collected the data from the website from Google browser and official telegram page of the restaurants, which included to the tables.

The steps are:
1. Define how many tables we need.
2. Identify the fields and columns we need and clarify the names and data in this columns. After the headers of the data table are clear, we started entering the data just below the respective column headings. In this database terminology, we called the rows Records, and columns called Fields.

When entering records we took into consideration these regulations:
➢ Do not leave any blank rows in the table. This includes not leaving a blank row between the column headings and the first row of data.
➢ A record must contain data about only one specific item.
➢ A record must also contain all the data in the database about that item. There cannot be information about an item in more than one row.
3. While rows in an Excel database are referred to as records, the columns are known as fields. Each column needs a heading to identify the data it contains. These headings are called field names. We used field names to ensure that the data for each record was entered in the same sequence. We entered the data in a column using the same format. Data collection done by collect data from website about gastronomic in Uzbekistan.

Data collection contains:
➢ How many tables related with gastronomic
➢ Data for each tables

In this research, gastronomic tourism data has 4 (four) tables, are:
1. Table of Country
2. Table of City
3. Table of Restaurant
4. Table of Menu

Ontology for Gastronomic tourism

Ontology for gastronomic tourism database has a superclass, the name of superclass is "Gastronomic". Based on data collection, we define subclasses are:
1. Country
2. City
3. Restaurant
4. Menu

Each subclass has an attributes, are:
5. Country: Country Code, Country Name

6. City: City Code, City Name
7. Restaurant: Restaurant Code, Restaurant Name, Address, Phone Number, Webpage, Opening Time, Closing Time
8. Menu: Menu Code, Menu Name, Price

Figure 3 shows the ontology for gastronomic tourism.

Figure 3. Ontology for Gastronomic tourism

XSD for Gastronomic tourism Ontology
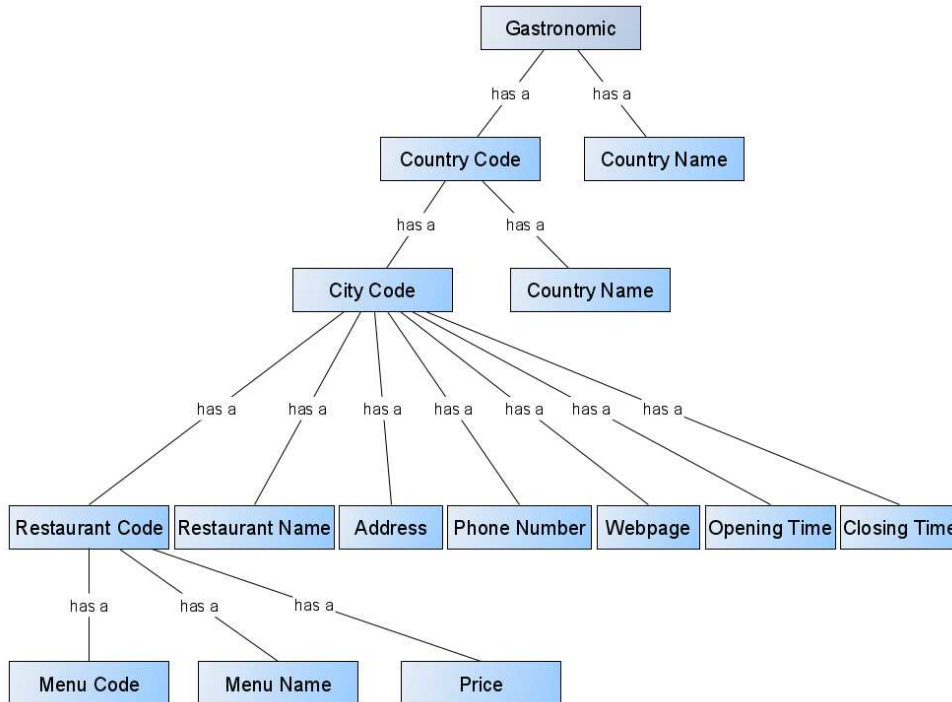XSD for Gastronomic tourism Ontology is as shown in Figure 4.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">

<xs:element name="Gastronomic">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="country_code" type="xs:string"/>
            <xs:element name="country_name" type="xs:string"/>
            <xs:element name="city_code" type="xs:string"/>
            <xs:element name="city_name" type="xs:string"/>
            <xs:element name="restaurant_">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="restaurant_code" type="xs:string"/>
                        <xs:element name="menu_">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="menu_code" type="xs:string"/>
                                    <xs:element name="menu_name" type="xs:string"/>
                                    <xs:element name="price" type="xs:string"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                        <xs:element name="restaurant_name" type="xs:string"/>
                        <xs:element name="address_" type="xs:string"/>
                        <xs:element name="phone_number" type="xs:string"/>
                        <xs:element name="web_page" type="xs:string"/>
                        <xs:element name="opening_time" type="xs:string"/>
                        <xs:element name="closing_time" type="xs:string"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>
</xs:element>
</xs:schema>
```

Figure 4. XSD for Gastronomic Ontology

Figure 4.2 is an XSD script for gastronomic ontology. There are several elements that consist of parent elements and child elements. The <xs: element name = "Gastronomic"> element is the root element or parent element. After that, there are other elements that define the contents of the "Gastronomic" element, such as <xs: element name = "country_code">, <xs: element name = "country_name">, <xs: element name = "city_code">, and <xs: element name = "city_name"> which has a string data type.

The <xs: element name = "restaurant _"> element is a derived element from the "Gastronomic" element. Derivative elements occur because the amount of data that has the same object in the "Gastronomic" element is more than one, so we need derived elements so that all data on these elements can be read completely. Other elements in the "restaurant_" element are <xs:element name = "restaurant_code">, <xs:element name = "restaurant_name">, <xs:element name = "address _">, <xs:element name = "phone_number">, <xs:element name = "web_page">, <xs:element name = "opening_time">, and <xs:element name = "closing_time"> which also have string data types.

In the "restaurant_" element there are also derived elements, namely <xs:element name = "menu _">. This element must exist because in a restaurant there are usually various types of menu choices. So it is necessary to create derived elements so that all data on these elements can be read completely. Other elements in the "menu_" element are <xs:element name = "menu_code">, <xs:element name = "menu_name">, and <xs:element name = "price"> with the string data type.

XML for Gastronomic tourism Ontology
XML for Gastronomic tourism Ontology can be seen in Figure 5.

```xml
<?xml version="1.0" encoding="utf-8"?>

<Gastronomic>
    <country_code>country_code</country_code>
    <country_name>country_name</country_name>
    <city_code>city_code</city_code>
    <city_name>city_name</city_name>
    <restaurant_>
        <restaurant_code>restaurant_code</restaurant_code>
            <menu_>
                <menu_code>menu_code</menu_code>
                <menu_name>menu_name</menu_name>
                <price>price</price>
            </menu_>
        <restaurant_name>restaurant_name</restaurant_name>
        <address_>address</address_>
        <phone_number>phone_number</phone_number>
        <web_page>web_page</web_page>
        <opening_time>opening_time</opening_time>
        <closing_time>closing_time</closing_time>
    </restaurant_>
</Gastronomic>
```

Figure 5. XML for Gastronomic tourism Ontology

Figure 4.3 is the XML program code for gastronomic ontology. XML creation must be based on a pre-built XSD framework or schema. The framework here means the arrangement of each program block in XML must match that made in XSD.

The XML structure for declaring the XML version used is contained in the first line of code, which is <? Xml version = "1.0" encoding = "utf-8">. The elements that contain the tag to describe the object consist of opening, body, and closing tags, such as <county_code> country_code </country_code>, <city_name> city_name </city_nama>, <restaurant_code> restaurant_code <restaurant_code>, <web_page > web_page </web_page>, <opening_time> opening_time </opening_time>. The contents between the opening tag and the closing tag are

filled in according to the data held and the program block code is repeated until all existing data have been entered.

It is clear that the XML program block for the gastronomic ontology follows the preconceived framework or schema in the XSD, with the same indent for each element. This XML schema has been validated through the web page http://www.utilities-online.info/, with the result of its validity being "XML Document is Well Formed".

XML Schema Definitions provide a rich set of predefined primitive types along with a mechanism to customize these types to create an accurate specification of XML documents.

The predefined types can be classified into several groups.
➢ Numeric
➢ Date and time
➢ XML types
➢ String
➢ Boolean
➢ URIs
➢ Binary data

CONCLUSION

The discussion in this research is about developing a database by designing ontology in tourism data. This study aims to answer the objectives of the research that has been carried out, after several series of analysis were carried out, three conclusions were obtained based on the method used, as follows:

1. The formation of a corpus scheme is done by creating XML Schema Definition (XSD) which produces an XSD documents. The resulting XML Schema Definitions (XSD) document was declared valid after testing the XSD scheme has been validated through the web page http://www.utilities-online.info/, with the result of its validity being "XSD Document is Well Formed and Valid".

2. Then, making Extensible Markup Language (XML) is done with the help of programs written using the Python programming language to produce XML documents. The Extensible Markup Language (XML) document produced has been declared valid after testing the validity of the document schema has been validated through the web page http://www.utilities-online.info/, with the result of its validity being "XML Document is Well Formed".

Suggestions

Based on the description of the research results and conclusions, there are several things that are recommended to the parties related to this research as follows:

➢ XSD can be used by programmers to verify each part of the item's content in the document; in this research XSD and XML documents were created for future researchers who will have desire for programming of Gastronomic tourism applications;

➢ The ontology concept created in this research is an example to prepare database for gastronomic tourism sector.

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