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An Ontology Based Tour Design Support to Extend Tourist's Cultural Interest

Krich Nasingkun

Japan Advanced Institute of Science and Technology

Doctoral Dissertation

An Ontology Based Tour Design Support to Extend Tourist's Cultural Interest

Krich Nasingkun

Supervisor: Professor Mitsuru Ikeda

School of Knowledge Science
Japan Advanced Institute of Science and Technology

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Abstract

Traveling is one of the most anticipated activities. It does not only give travelers a sense of relaxation, but also a chance to learn new things and to experience different cultures. Recently, traveling has been targeted at several types such as natural based traveling, cultural based traveling and adventure traveling. In Thailand, the campaign of cultural based traveling has been raised to promote Thai cultural heritages. In cultural touring, a visited site may contain many interesting contents in several aspects. These include tangible heritages such as object, product and intangible culture heritages such as folklores, rituals and traditions. For tangible heritages, each site has its own story worthy of learning for tourists in terms of cultural importance. The story may involve several aspects such as its creator, its former place, related tales, etc. These are background knowledge of heritage to connect tangible and intangible cultures together that are able to implicitly provide travelers with experience of surrounded cultural knowledge.

However, background of the heritages is apparently scattered in museums and in tales of their surrounding areas. Only historical or cultural experts accumulate the knowledge while typical tourists can rarely access the information and lack opportunity to fully appreciate the cultural heritages in these aspects. For cultural-based travelers, their points of interest can be individually different; some may enjoy sightseeing of heritages based on their favorite characters (such as famous poets or kings) while some may follow their religious belief for the sacred artifacts according to the tales (such as a tale of Naga, mythical being in South East Asia worshiped to reward in prosperity). Despite their favorite, very few people visited all related heritages or missed to learn the related details because of the lack of cultural story knowledge. Hence, transferring knowledge in these cultural aspects is crucial in promoting cultural tourism activities.

The aim of this work is to connect cultural heritages with their relation in several aspects. To allows users to learn more about cultural aspects hidden within heritages' history and let them fully experience the culture traveling despite the lack of initial background knowledge of the tourist site. Furthermore, it can also help to promote the hidden value of heritages and motivate to learn more of the related heritages since they learnt some insight details.

Keyword: Tour Design Support, Extend Viewpoint, Cultural Aspect, Ontology, Mixed Initiative Search

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Chapter 1
Introduction

Tourist industry has continued on expansion and diversification to become one of the largest and fastest-growing economic sectors in the world over the past six decades. UNWTO reveal that tourism rank as the third industry after fuels and chemicals industry and ahead of food and automotive products. Tourism also rank as the main export sector in many developing countries. Total generate income in destinations, more than US$ 211 billion in exports though international passenger transport services. In 2015, tourism can generate value of exports up to US$ 1.5 trillion (see Figure 1.1).

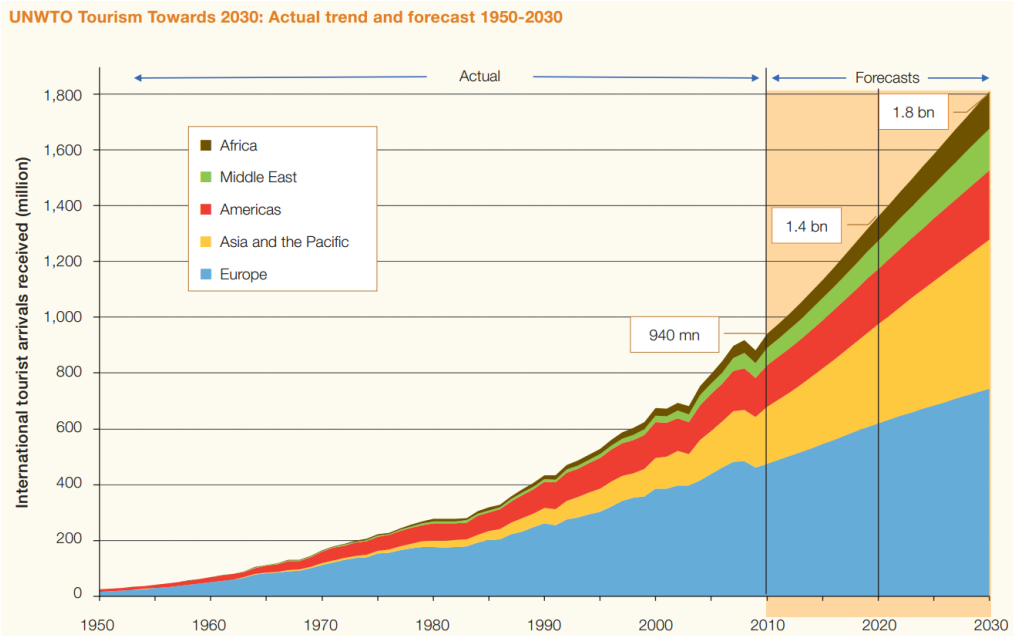

Figure 1.1 UNWTO Tourism Towards 2030: Actual trend and forecast 1950-2030 (source: World Tourism Organization).

The interesting information is, a growing number of special-interest travelers who interesting in arts, heritage and/or other cultural activities. These visitors are known as cultural tourist. Information from Travel Industry Association of America (TIA) shown that, Nearly 118.1 million American adults always included at least one of tourism activities while traveling in 2002. Thirty percent or 35.3 million of them express their interest in a specific components of heritages

such as arts, cultural activities or festival that influenced their choice of selection the destination. In fact, cultural activities is the top reason for visitor to extend their holiday trip (Travel Industry Association of America Travel Scope survey 2003).

In cultural touring, a visited site contains many interesting contents in several aspects. These include tangible heritages such as buildings and artifacts, and intangible culture heritages such as folklores, rituals and traditions. For tangible heritages, each has its own story worthy of learning for tourists in terms of cultural importance. The story involves in aspects such as its creator, its former place, related tales, etc. These are background knowledge of heritage to connect tangible and intangible cultures together and are able to implicitly provide travelers to experience rounded cultural knowledge.

However, the background of heritages is apparently scattered in museums and in tales of their surrounding area. Only historical or cultural experts accumulate the knowledge while common tourists can rarely access the information and lack opportunity to fully appreciate the cultural heritages in these aspects. For cultural-based travelers, their points of interest can be individually different; some may enjoy sightseeing heritages based on their favorite characters (such as the famous poet or the past king) while some may follow their religious belief for the sacred artifacts according to the tales (such as a tale of Naga, mythical being in South East Asia worshiped to reward in prosperity). Despite their favorite, very few people rarely visited all related heritages or missed to learn the related details because of the lack of cultural story knowledge. Hence, transferring knowledge in these cultural aspects is crucial in promoting cultural tourism activities.

Visitors have held of theirs belief, values, assumptions, and the way they view the world. All of them may have the interest, but most may not have sufficient knowledge to roundly realize the values of cultural resources in a tourism destination. Thus, it eventually is difficult for a visitor to fully benefit from cultural tourism activities. In details, visitors cannot identify or miss values that they want to learn, experience and entertain from. They will arrange the trip plan based on their prior-knowledge that may not reflect the real values of destination that they may interest. To get better benefit from cultural tourism sites, information services may act as cultural expert to provide surrounding information that reflect to the values of cultural sites. Visitor should have a chance to control and design their trip based the values that they fully appreciate. However, It is quite difficult for the information service to provide tourism information adapt to each visitor's stereotype in cultural tourism. Moreover, it becomes harder for a visitor to adapt his viewpoints to an unfamiliar cultural destination.

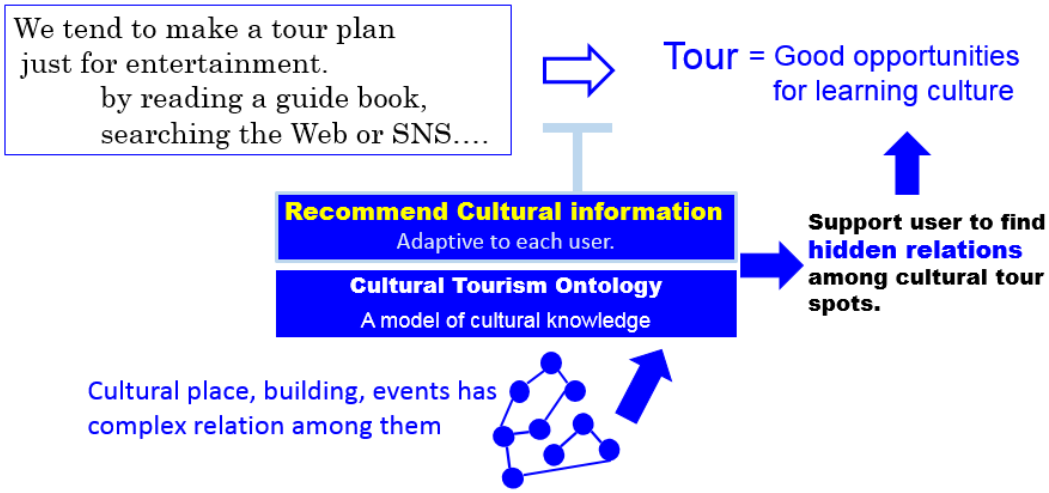

Figure 1.2 Approach to Open Visitor's Eyes

In this research we aim to propose an approach to open visitor's eyes to new destination culture. Complex relation among cultural heritages and cultural place will be represented by the proposed Cultural Tourism Ontology. Adaptive recommendation service are used to support visitor to connect cultural heritages with their relations in several aspects. The proposed recommendation system will inform about the relations for the users to learn more about cultural aspects hidden within heritages' history and let them fully experience the culture-based traveling despite the lack of initial background knowledge of the tourist site. Furthermore, it can also help to promote the hidden values of heritages and motivate the users to learn more about the related heritages since they learnt some insightful details. Using this approach, users have the freedom to access any aspect of destination culture. System will provide rounded information to support user interest. In particular, users are allowed to keep control of the interaction and to inform details and select their interests among the provided candidate. Without prior-knowledge of destination, hidden relations can be reveal by this approach. System provides the relevant information by offering easy ways to explore the options without the need to specify and modify the information search. User can consume as much as they prefer.

Dissertation Overview

The dissertation is divided into an additional six chapters, as follows:

Chapter two will present the background and related work including of digitized-thailand project— digital information infrastructure that aims to preservation and utilization of Thailand culture, cultural tourism—scope and definition, and existing information system for support tourism.

Chapter three will present the motivation and detail information of cultural tourism ontology and cultural aspects in order to represent cultural values of cultural tourism destination.

Chapter four will present the mixed initiative culture-based framework that has been developed for the purposes of this research. Discussion will be outlined in terms of "how the proposed system can help visitor to open eyes to cultural tourism destination and extend their interest in destination culture?"

Chapter five will describe the result of experiment, visitor's behavior to the use of mixed initiative culture-based tourism system. This chapter also provides a brief discussion and limitation of the result.

Chapter six will present the conclusion and further work direction. It will review the general research process and its finding. This chapter discusses reflection to the research contributions and limitations, and exposed the future research directions.

Chapter 2
Background and Related Works

2.1 Introduction

This chapter reviews the related researches in tourism support purpose. First of all, I give the information of Digitized Thailand project that we used as a reliable source of cultural information in this research. I then discuss a characteristic of Cultural Tourism. Finally, I discuss the functionality of existing tour design support system.

2.2 Digitized Thailand

"*Thai traditional way of life is probably fading away from people in the modern society, but the technology can help to recalling what's in people's memory to come alive*", Digitized Thailand (2010).

Digitized Thailand is flagship project of National Electronics and Computer Technology Center (NECTEC), Thailand to provide information platform for the integration of technology developments, which have been done for over two decades.

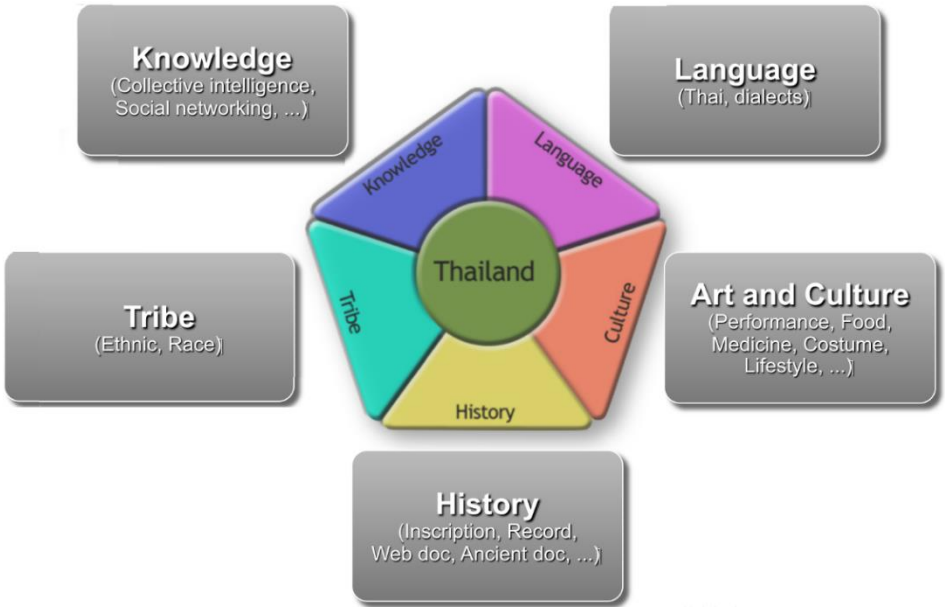

Figure 2.1 What is Thailand and What is to digitized

Its goal is to establish digital information service platform that allow Thai people to keep access their identity. Finally, will eventually be developed into national archive and knowledge center. Digitized Thailand set to be the long-term project. They focusing on five key areas; Digital Content Development; Research and Development on related Technologies; Standardization; Apply and Services; and
Digital Right Management.

- Digital Content Development

  The development of digital content is divided into two steps:

  - Digital content archival involves the transformation of unstructured digital data including web documents, audio data, images, video as well as social documents into structured data and build them up into digital archive for easier retrieval.

  - Digital content creation is a process to develop new digital contents for significant domains together with transforming existing analog-based information of history, art and culture, knowledge, local wisdom, news and other vital information into digital form.

- Research and Development on related Technologies

  Including with Technologies for Data Creation, Technologies for Data Accumulation, Technologies for Data Access, Technologies for Data Analysis, Technologies for Data Applying and Technologies for Data Sharing.

- Standardization

  Under DT project, it's essential to make digital data in different systems accessible seamlessly. Standardization is therefore required to store, organize, link and integrate information in the digital universe.

- Applications and Services

  A significant mission of DT project is to encourage the utilization of information and technological tools to develop new digital services to benefit the country's education, society and business. So far, many projects have been developed to offer information services to Thai society. Those include Digitized Lanna project -- to provide local wisdom database of the Lanna Kingdom; Herbal Informatics project -- to provide Thai herbs information to support local medical and health care circles; and Thai Web Archive project. The plan also encourages the development of other services including the service for digitized process, immigration conversion, information extraction, and hosting.

To accumulate information, Digitized Thailand created collaboration projects with variety of partner including national organization, university, local museum, libraries and learning center as well as institutions and universities (see Figure 2.2) to convert the country' s significant data (see Figure 2.1) such as history, art, culture, local wisdom and rare documents into digital format.

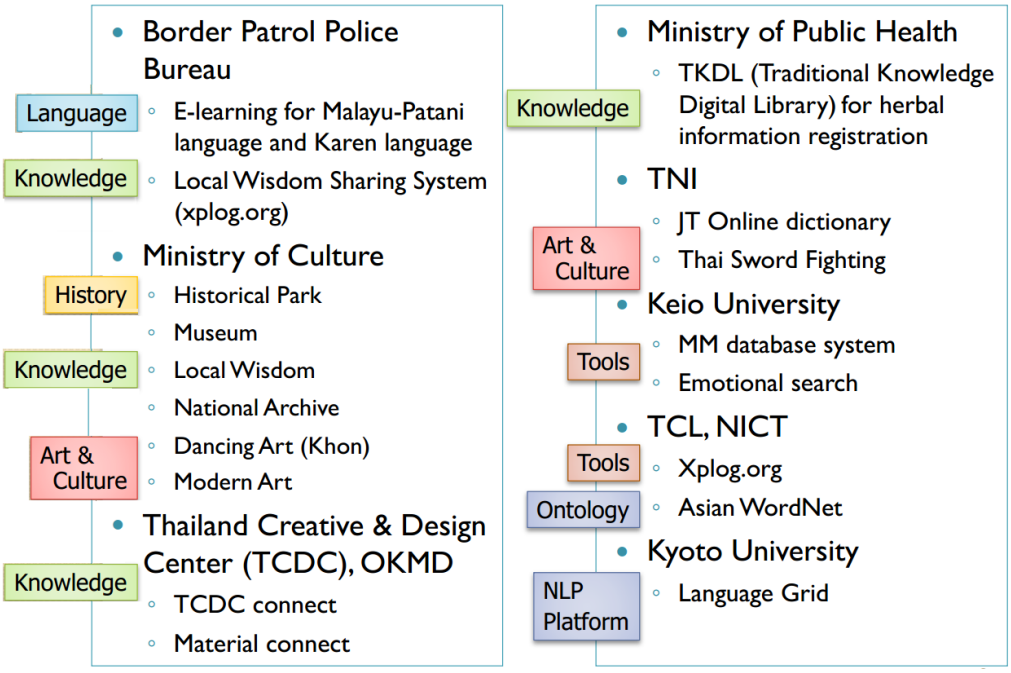

Figure 2.2 Digitized Thailand Partners and Tools

For example, by the cooperated with Silpakorn University and Price of Songkla University to collect knowledge related to Thai herbs to build up digital Thai herb archive under Knowledge Unifying Initiator for Herbal Information or KuiHerb project. To collect the local wisdom, they collaborate with local university such as Chiangmai University to accumulate local wisdom of Lanna Kingdom in the northern part of Thailand. Traditional performance such as Digital Khon is the collaboration project with Mahasarakham University in northeastern region.

Digital Khon project.

As Khon is a significant Thai masked-dancing performance, which has had a long history since Ayutthaya period, they collaborated with Chulalongkorn University to accumulate vital information related to Thai Khon to build up a digital information database that allows people to discover the magnificence of Thai Khon performance. Under Digital Khon project, information such as Khon' s history, its dancing postures as well as all splendid costumes are digitized (See Figure 2.3). Not only does the system offer people valuable knowledge for further study on Thai cultural arts, the system is also a foundation to help the country develop efficient management system for the preservation of Thai Khon performance.

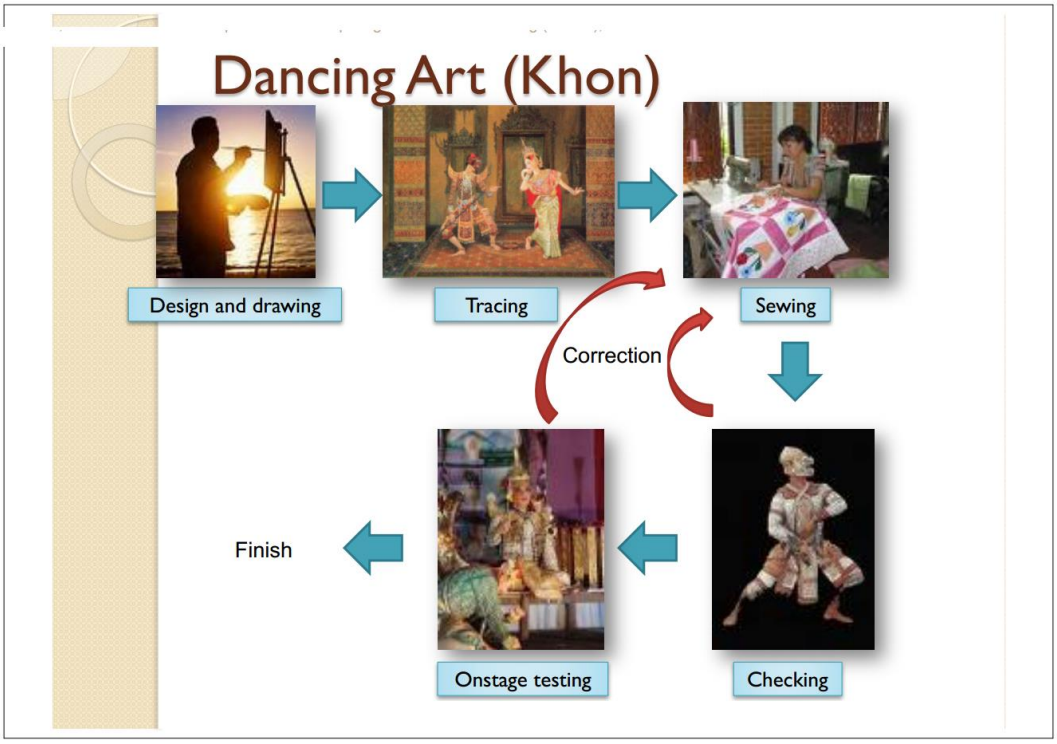

Figure 2.3 Digital Khon

By utilizing digital Khon database, the university plans to develop inventory management system for Khon costumes using radio frequency identification (RFID) technology. Since Khon costumes comprise of many components and each item is costly, the new system will help track the items to make costume management system much more efficient. The plan also covers the development of computer-aided design program to facilitate designers to design Khon costume and simulate the costume model virtually. Designers can see a complete costume, make any changes digitally, and finish the final patterns all on computer screen.

To collect information of cultural heritages and digitally store them as cultural archive (see Figure 2.4). The project, was supported and under supervision by a collaboration of Ministry of Culture. The archive is a collection of multimodal information including image, location and detailed history for public access for over 100,000 entries (see www.m-culture.in.th) from 28,640 sites (5 heritages/sites in averages) across Thailand. This can be a reliable initial resource for relating cultural heritages to create multi-aspect knowledge for cultural tourist activity.

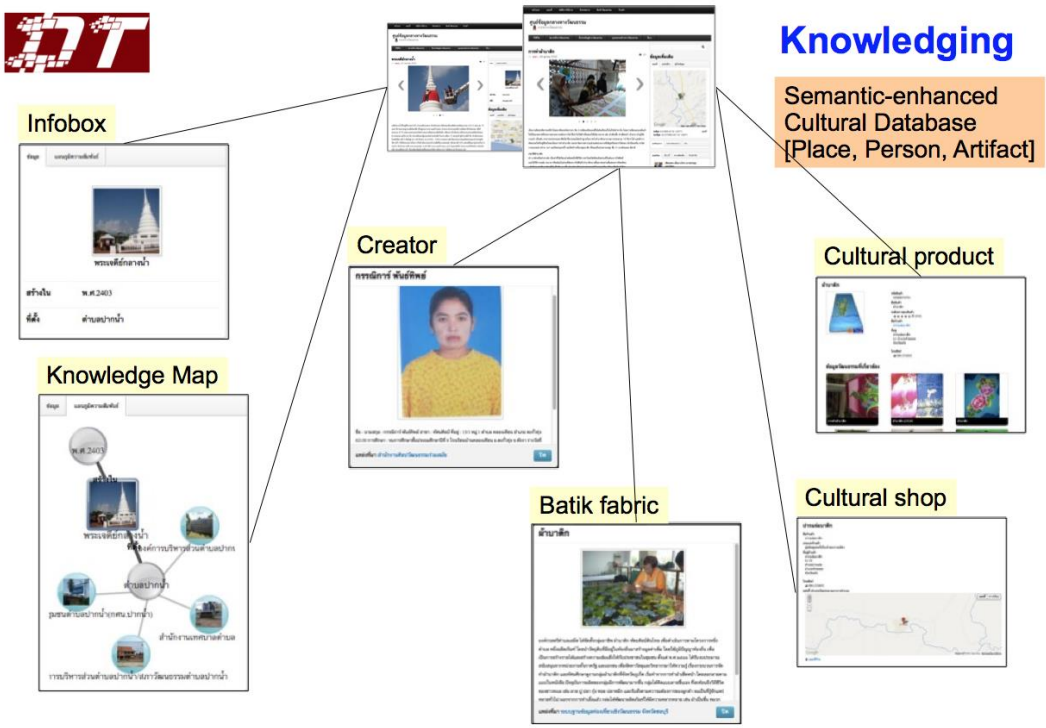

Figure 2.4. Cultural Database in Digital Thailand

2.3 Cultural Tourism

2.3.1 Culture

Culture is a term in arguing for a concrete definition. In his publication, Raymond Williams viewed the term "Culture' as one of the most complicated words in the many languages with several meanings in interpretation (William, 1983)". Littrell defined the meaning as "culture can be viewed as comprising what people think (attitudes, beliefs, ideas and values), what people do (normative behavior patterns, or way of life) and what people make (artworks, artifacts, cultural products) (Littrell, 1997)". Moreover, many philosophers such as Tylor (1871), Hofsted (1997) and Harvey (2001) proposed a different definition of culture. However, the well-accepted definitions is given by Roshan Cultural Heritage Institute as "Culture refers to the following Ways of Life" (see http://www.roshan-institute.org). A scope of the meaning includes the followings.

- Language: the oldest human institution and the most sophisticated medium of expression.
- Arts & Sciences: the most advanced and refined forms of human expression.
- Thought: the ways in which people perceive, interpret, and understand the world around them.

- Spirituality: the value system transmitted through generations for the inner well-being of human beings, expressed through language and actions.
- Social activity: the shared pursuits within a cultural community, demonstrated in a variety of festivities and life-celebrating events.
- Interaction: the social aspects of human contact, including the give-and-take of socialization, negotiation, protocol, and conventions".

Another definition from well-known organization "UNESCO" is "[Culture] is that complex whole which includes knowledge, beliefs, arts, morals, laws, customs, and any other capabilities and habits acquired by [a human] as a member of society."

In summary, culture cover all activities that related to lifestyle or multitude of people in the society. Including with spoken and written language, behavior, lifestyle, customs, heritage, ideology and even technology connect the individuals to groups of people in a certain culture. In addition, contemporary and new popular culture that represent people way of life can also take to accounted a culture.

In this paper, I model cultural tourism ontology based on the definition from Roshan Cultural Heritage Institute, Littrell (1997) and UNESCO in order to capture as much as possible of cultural aspects to benefit in cultural tour designing system.

2.3.2 Cultural Tourism

RICHARDS (2009) states that *"Culture and tourism were two of the major growth industries of the 20th century, and towards the end of the century the combination of these two sectors into 'cultural tourism' had become one of the most desirable development options for countries and regions around the world."*

Cultural tourism is acknowledged as one of major growth areas throughout Europe since it can bring in income to a country and jobs for citizen. Hence, the European Commission and national, regional and local governments all over Europe decided to focus on promoting and supporting cultural tourism (Richards, 1996). With a change of trends in tourism, visitors has more participated in cultural activities, and this shows that it becomes a part of favorable tourism type among other types (Figure 2.5).

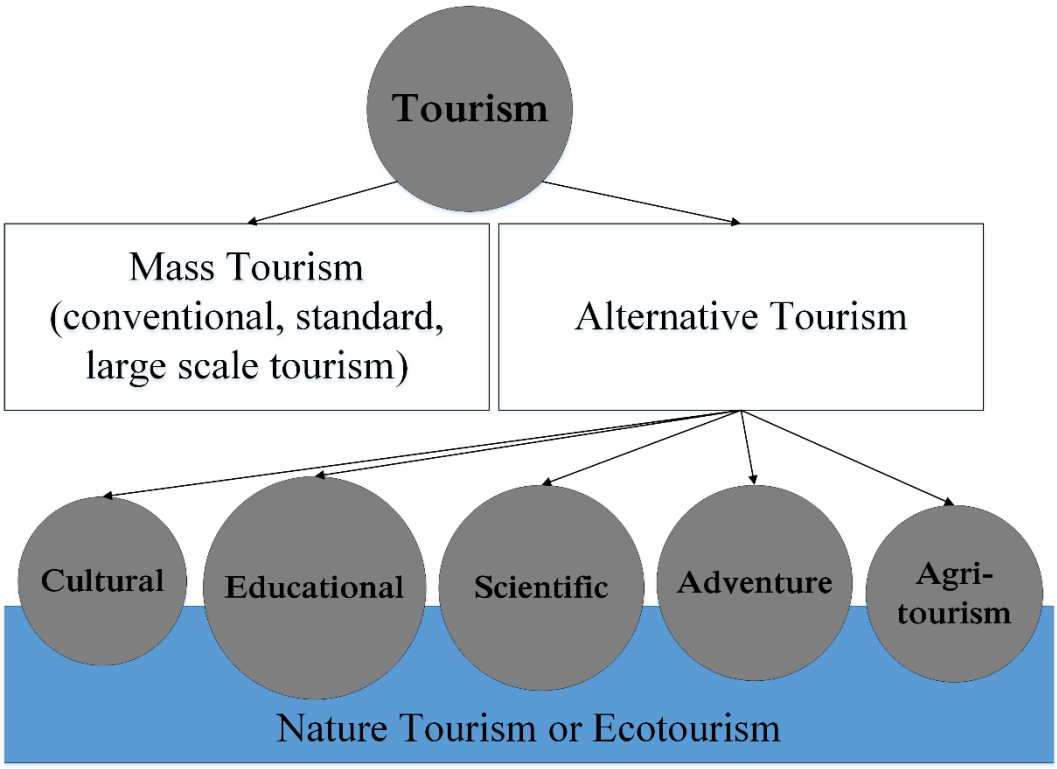

Figure 2.5. The role and place of cultural tourism within alternative tourism (Mieczkowski, 1995)

Stebbins (1996) states that "*Cultural tourism is a genre of special interest tourism based on the search for and participation in new and deep cultural experiences, whether aesthetic, intellectual, emotional, or psychological.*"

In 1991, the European Association for Tourism and Leisure Education (ATLAS) launched its Cultural Tourism Project. The project was initially funded by DGXXIII of the European Commission. They make the effort to understand the nature of cultural tourism by start project to survey the cultural tourism market in Europe. This is a starting point improving cultural tourism and its related research (van 't Riet, 1995; Goedhart, 1997; Herrijgers, 1998; McKercher and Hillary, 2002) in European countries. Include cultural tourism motivation, cultural tourism policy, cultural tourism products and typology of cultural tourist respectively.

As a result among various researches, McKercher and Du Cros (McKercher and Hillary, 2002) proposed four different types of cultural tourism definitions according to different objectives of the usage: tourism derived definitions, motivational definitions, experiential or aspirational definitions and operational definitions as shown in Figure 2.6.

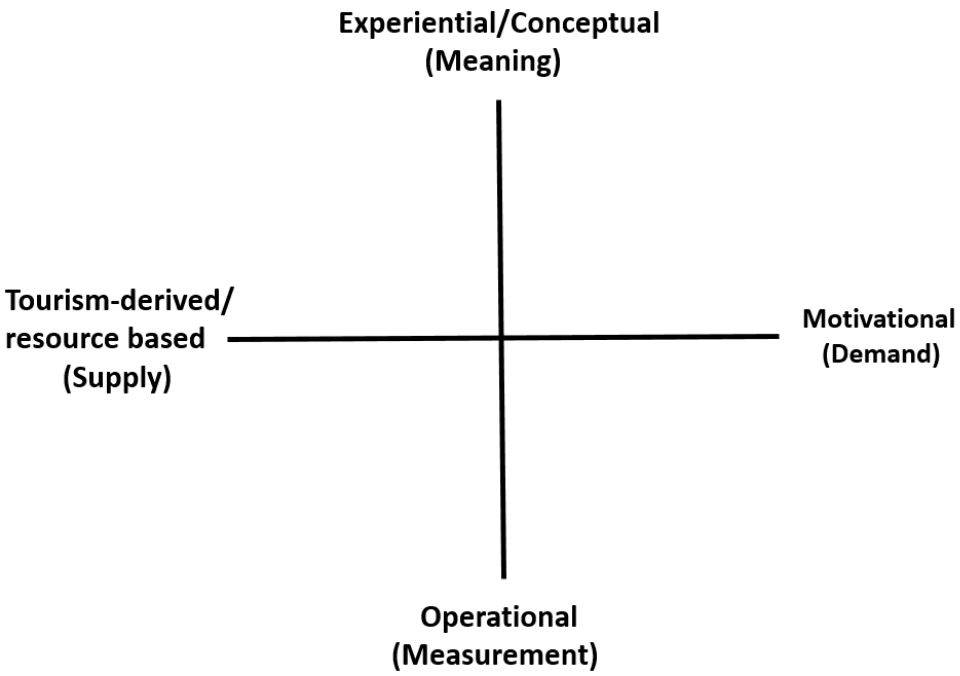

Figure 2.6. The definition field of cultural tourism (McKercher and Hillary, 2002)

From the Figure 2.6, the graphic was defined and proposed by ATLAS as '*The movement of persons to cultural attractions away from their normal place of residence, with the intention to gather new information and experiences to satisfy their cultural needs*'.

According to these several definitions, ECTARC (1989) define the resources involved in cultural tourism as:

a) Archaeological sites and museums

b) Architecture (ruins, famous buildings, whole towns)

c) Art, sculpture, crafts, galleries, festivals, events

d) Music and dance (classical, folk, contemporary)

e) Drama (theatre, films, dramatists)

f) Language and literature study, tours, events

g) Religious festivals, pilgrimages

i) Complete (folk or primitive) cultures and sub-cultures.

Similarly, Munsters (1996) proposed a classification of a wide range of cultural tourism attractions in the Netherlands and Belgium as follows:

1. Attractions:

a) Monuments
b) Museums
c) Routes
d) Theme parks

2. Events:

a) Cultural-historic events
b) Art events
c) Events and Attractions

However, the classification from Munsters was not accepted by other since he included 'theme parks' as cultural attractions.

With many definitions and scopes, it is difficult to decide which one is better. So in this research, I adopted the definitions from others and defined cultural tourism to fit scope in this research as "*a genre of special interest tourism that visitor has a specific purpose to learn, experience and entertain from the values of cultural resources to broaden and deepen his or her understanding. The value of cultural resources are not only physical attributes but also including with its aspect such as belief, folk wisdom (social's knowledge), arts, history, etc.*" (Adapted from Stebbins, 1996)

2.3.3 Cultural Tourist Typologies

To better understand nature of cultural tourist, many research proposed idea to classify them. Most typologies of cultural tourism are designed based on the level of motivation of tourists with the value of destination culture. Ranking from those with a fairly general or superficial interest in culture to those with a very specific and/or strong interest in culture. Among those, Smith (2003) proposed a typology of cultural tourists based on type of visited place and activities as given in Table 2.1.

Table 2.1 A Typology of Cultural Tourism by Smith (2003)

Type of cultural tourist	**Typical places/activities of interest**

Heritage tourist	Visits to Castles, Palaces, Country houses, Archaeological sites, Monuments, Architecture, Museums, Religious sites
Arts tourist	Visits to Theatre, Concerts, Galleries, Festivals, Carnivals and events, Literary sites
Creative tourist	Photography, Painting, Pottery, Cookery, Crafts, Language learning
Urban cultural tourist	Historic cities, Regenerated industrial cities, Waterfront developments, Arts and heritage attractions, Shopping, Nightlife
Rural cultural tourist	Village, Farm or agro-tourism, Eco museums, Cultural landscapes, National parks, Wine trails
Indigenous cultural tourist	Hill tribe, Desert or mountain trekking, Visits to cultural centers, Arts and crafts, Cultural performances, Festivals
Popular cultural tourist	Theme parks and themed attractions, Shopping malls, Pop concerts, Sporting events, Media and film sets, Industrial heritage sites, Fashion and design museums

A more complex typology was proposed by McKercher and Hillary (2002). The proposed typology is different since it does not only concern on the importance of culture in the decision to travel, but the 'depth of experience' gained by the tourist. Based on the idea, they produced a two-dimensional typology dividing cultural tourists into five groups as shown in Figure 2.7. Base on the idea, the extent of a tourist involved in cultural tourism is a key to distinct a group.

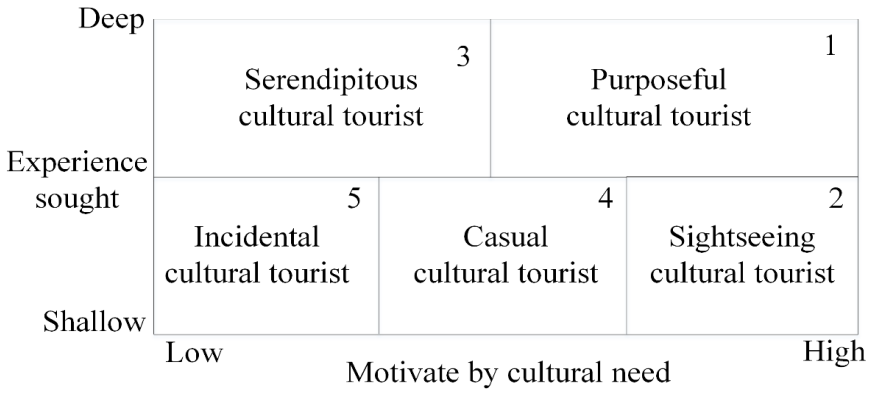

Figure 2.7. Cultural Tourist Typologies: McKercher and Hillary (2002).

Nevertheless, cultural interest is an immense challenge for tourism promoters and government agencies, because the insights of local heritage and points of interest are physically scattered and usually intangible among the locals. Knowledge elicitation is therefore an indispensable step for cultural knowledge integration. Without it, preference-based recommendation for cultural tourists would become impossible.

2.4 Information for Tour Design Support

Recommender systems for cultural tourism differ from ones for mass traditional tourism in that it has to satisfy the tourists' demand to gain new experiences and information in cultural attractions whose insights are physically scattered and usually intangible. Some recommender systems start to offer various options that approach to preference-based cultural tourism; for instance, personal interest (Soo and Liang, 2001; Ardissono et al., 2002, 2003; Niaraki and Kim, 2009), integrated selection and routing (ten Hagen et al., 2005; Shiraishi et al., 2005a,b), mandatory POIs (Castillo et al., 2008), multiple-days planning (Kinoshita et al., 2006; Lee et al., 2009), limited budget (Castillo et al., 2008), group profiles (Nagata et al., 2006), and types of cultural tourism (Ardissono et al., 2002, 2003). However, to utilize these options efficiently, the tourists need some prior knowledge about the cultural attractions. This makes it hard for unsettled tourists who have exact preferences on cultures they want to get exposed to but have not decided their destinations. We will address this problem in this paper by introducing a recommender system that assists these unsettled tourists with clear cultural preferences.

To compare these tour planning systems and services, features to show properties, functions and methods are designed to find differences. Table 2.2 gives a comparison result separated by features. To assist in understanding, a description of each feature is as follows.

- *Personal Interest Estimation* The collected user attributes are to be matched with location or activity attributes. The POIs and hotels can be sorted according to this quantified value. Base on that information, system will provide the most possible appropriateness of a hotel, or the "beautifulness" of a scenic route.
- *Distinct/Integrated Selection and Routing* to provide a tailored made route on the trip. Current location (via GPS), target POIs and information of available time slot is used to recommend the best path in each stage of the trip. When combined with the personal interest estimation, the resulting route is tailored regarding the user's interest.
- *Mandatory POIs* by this function, visitor will get the recommend result to the popular place of the destination country. It can ensure that visitor will be routed to the "must see." Or "land mark". Top of the POIs always presented as the candidate to visit. However, tourist can also indicate a POI

as mandatory, if he is aware of a POI he certainly wants to visit, for example, the one recommended by friends or family.

- *Planning for multiple* days can be achieved by the Multiple Day Decision Support. By collecting the preference of user in a series of days. Also, the *Opening Hours* of POIs should be taken into account when visiting. A calendar is used to define the opening hours of each POI. Therefore, this feature can make sure the smooth of the visit plan.
- *Budget Limitations* this feature is useful when the tourist has a maximum amount of money to spend. Money budget and all cost information in the destination will be taken into account.
- *Group Profiles* manage the single person and the group of tourist are totally different approach. System should provide the trip plan based all an average preference of all visitor.
- *Value of Cultural tourism sites* viewpoints, such as the historical period, artistic current, types of monuments, and so forth.

Table 2.2 Functionality overview (adapted from Souffriau and Vansteenwegen, 2010)

	personal interest estimation	distinct selection and routing	integrated selection and routing	mandatory POIs	multiple days	opening hours	budget limitations	group profile	Value of cultural tourism sites
[Soo and Liang, 2001]	x		x						
[Ardissono et al., 2002, 2003]	x	?	?			x		x	?
[Suna and Lee, 2004]	x		x						
[Maruyama et al., 2004a,b]			x			x			
[ten Hagen et al., 2005]	x		x						
[Shiraishi et al., 2005a,b]			x			x	x		
[Kinoshita et al., 2006]			x		x	x			
[Nagata et al., 2006]			x			x		x	
[Lee et al., 2007]	x		x						
[Castillo et al., 2008]	x	x		x		x	x		
[Lee et al., 2009]	x	x			x				
[Wu et al., 2009]						x			
[Niaraki and Kim, 2009]	x								
[Yu and Chang, 2009]	x		x						
[Huang & Bian, 2009]	x		x	x		x			
[Vansteenwegen et al., 2010]	x		x	x	x	x			
[Blanco et al., 2010]	x								
[Moreno, et al, 2013]	x								

Table 2.2 show the summary of existing service/functionality for tourism. However, special purpose tourism such as cultural tourism has their specific characters. Visitors focus on values of the culture that they can learn, experience and entertain. Cultural values of tourism sites should be the main constrain in the trip planning process (not only distance/budget/popularity/etc.). The trip plan should be used as the guideline to create an environment for support visitors to fill their needed. Without concern for cultural values, the goal of cultural tourism may not be reached

2.5 Summary

The review related study show the background and discussion related of information service for tour design support issues. However, according to the comparison and the evidence of related study, rarely of those research focus on the support for cultural tourism (most of the research focus on the mass tourism). Hence, this research idea was to take into account on the support of cultural tourism, by encourage cultural tourist to open eyes to destination cultural and get the new insight to adjust their viewpoints in foreign country.

Chapter 3
Cultural Tourism Ontology

3.1 Introduction

This chapter will discuss the design of cultural tourism ontology. First of all, I discuss about existing tourism and culture ontology. Then, I continue to discuss the expectation of cultural tourist from tourism site; and introduce Cultural Aspects as a tool to explore the viewpoint of destination society. Finally, the discussion will illustrate the detail of the designed cultural tourism ontology for cultural tourism.

3.2 Culture and Tourism related Ontologies

3.2.1 Ontologies

Berners-Lee et al., (2001) state that "Ontologies define areas of common understanding between multiple actors, easing their interoperability and permitting a high-level communication". Ontologies use as a formal representation of a domain of knowledge. Concepts and relations between them have to explicit represent to reflect the real situation in specific domain. The most well-known definition commonly cited in the Semantic Web and Knowledge Representation communities from Gruber (1993), i.e.:

"*An ontology is an explicit and formal specification of a conceptualization of a domain of interest*".

Classes, properties, instances and axioms is the components of ontologies. Figure 3.1 show an example of ontology structure, concept PhD student is what we call class and all instances of PhD students are real world persons. Super concept and sub concept relations is the mechanism to represent general and specific of thing, also called *is_a* hierarchy. For example, any PhD student is also a student and for the student concept a more general concept would be person. In addition, reasoning mechanism is the real power of ontologies to deriving logical conclusion from the domain of interest.

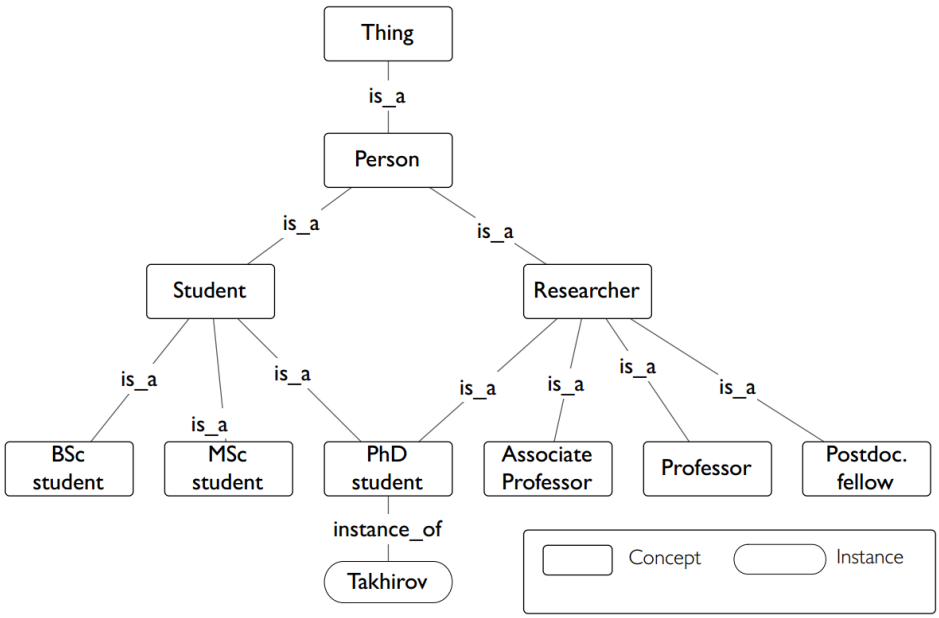

Figure 3.1 An Example of an Ontology Structure.

3.2.2 Tourism Ontology

World Tourism Organization (WTO) has been made an effort to develop a global standard of catalogs and taxonomies. In order to exchange data between travel agency and all stakeholder. In 2007, Prantner et al develop Mondeca tourism ontology on top of WTO taxonomies with around 1,000 concepts. Well-known ontologies are DERI e-tourism (Hepp et al., 2006), Harmonize and Harmonize2 that aims to solve interoperability problems in tourism domain activities such as attractions, events, food and drink and accommodation. Another ontology is cDOTT ontology (Barta et al., 2009) that aims to support low-level operations of travel agent. Finally, in the question answering system, Ou et al (2008) introduce QALL-ME, tourism ontology for question answering in multimodal and multilingual.

However, Most of the existing tourism ontology are developed for mass tourism, none of them focusing on specific interest group such as cultural tourism who want to consume cultural aspects of destination. Detail information of cultural resources/heritages not be able to represent in the existing ontology.

3.2.3 Cultural Ontology

One of the popular methods for knowledge elicitation is to represent knowledge in terms of ontology, whereby each concept is represented as a node of

a hierarchical taxonomy and one concept can be linked to another via a labeled vertex (i.e. relation). When applying to the culture domain, an ontology becomes very rich and complex. At present, there are several ontologies for eliciting cultural knowledge: CIDOC Conceptual Reference Model (Doerr, 2003), Finnish Cultural Portal's situation ontology (Junnila et al., 2006), Europeana Data Model (EDM) (Doerr, 2010), and More Advance Upper Ontology for Culture (MAOUC) (Blanchard and Mizoguchi, 2014). All of these ontologies were designed to capture detailed cultural knowledge as logical, deducible facts and are not well suitable for preference-based recommendation. We will design an ontology on top of these ontologies to capture the tourists' preferences in cultural attractions.

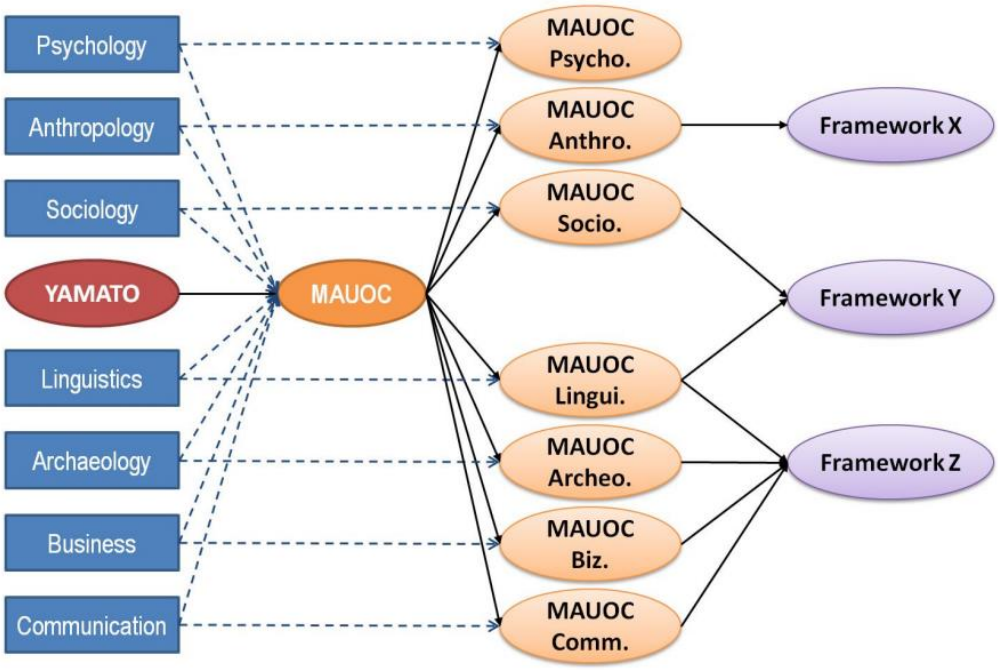

Figure 3.2 The MAUOC Ontology Ecology (Blanchard and Mizoguchi, 2014).

By our knowledge, most of the existing cultural ontologies are designed for generally use in culture domain and abstract layer on the purpose of preservation, exchange, and information education. None of them focuses on supporting cultural tourism activities.

3.3 Describe Point Of Interest in Context of Cultural Tourism

Cultural tourism is "*a genre of special interest tourism that visitor has a specific purpose to learn, experience and entertain from the values of cultural resources to broaden and deepen his or her understanding. The values of cultural resources are*

not only physical attributes but also including with its aspect such as belief, folk wisdom (social's knowledge), arts, history, etc."

The motivation for describing Point of Interest in the context of cultural tourism is to make it easier to understand the nature of cultural tourist, what kind of information they looking for and where are the sources of information they can get from. In cultural tourism, visitors focus on values of the culture that they can learn, experience and entertain from. A visited site contains many interesting contents in several aspects. These include tangible heritages such as buildings and artifacts, and intangible culture heritages such as folklores, rituals and traditions. For tangible heritages, each has its own story worthy of learning for tourists in terms of cultural importance. The story involves in aspects such as its creator, its former place, related tales, etc. These are background knowledge of heritage to connect tangible and intangible cultures together and are able to implicitly provide travelers to experience rounded cultural knowledge.

Kelly (1999) state that "*People want to hear stories: they are an ancient method of spending time, educating and having fun. Stories bring new points of view to the Point of Interest and its belonging heritages*".

To understand the nature of stories that mentions in this research, we will used the definition from Eric Miller (2010) that proposed Three Kinds of stories.

1. Traditional stories: type of traditional stories include Folk Tale, Legend, Epic and Myth.
    a. Folktales tend to be timeless and placeless, with characters that are well-known in a culture. One type of Folktale is a Fairytale -- Fairytales have a magical element.

    b. Legends are historical stories, which took place in a certain place, often in the distant past, with some divine element.

    c. Characters in myths are divine figures. Myths often concern the creation of the physical world, and occur before human history.

    Example: The Wizard of Oz, Princess Kaguya, Khun Chang Chun Phaen (Thai folktale), Alexander the Great, Ramayana Epic and Myth of Zeus

2. Personal Experience stories: Regarding Personal Experience stories -- Telling a story involves expressing points of view -- that an event is significant, and how one feels about it.

    Example: "For Temple of Reclining Buddha, we got there a little late, but I could not stop being astonished by the beauty of the temple. 1 hour was to

short, but 2-3 hours should be a good time frame. Included in the entrance fee is also a bottle of water"

3. Created stories: Created stories often involve a mix of elements from Personal Experience stories and Traditional stories.

   Example: "In the first day of the trip, we will visit Wat Phra Kaew to see the well-known mural and statue from Ramayana epic. This place also exhibited the most famous Buddha image call Emerald Buddha. The long traverse stories of Emerald Buddha start from the northern part of Thailand…"

In this research, cultural aspects were chosen as the key for connecting different resources semantically. Cultural aspect will act as the subject of interest in the stories. Traditional stories was represented as folktale (intangible cultural heritages, see more details in the next section). System will provide rounded information that may interested by visitor. The result of the proposed recommendation service will help visitor create their interest stories thorough the list of interested trip plan. In another word, visitor can get support from system to create their own stories (Personal Experience stories and Created story) according to the information of cultural aspect from the recommender system.

Let us give an example of Point of Interests and their connection to each other though cultural aspects. Considering a tangible cultural heritage that has creator as "King Rama I". We know that the tangible heritage is exhibited at the Point of Interest that visitor visited for fulfill cultural needs. Another Point of Interest may links to this by have the same king as the founder, place of living, monument or the place of related historical event. By this concept, all type of Point of Interest may be linked to each other in some aspects (by specific values).

In this context, the stories of specific subject will represent an identity of specific society. We will use the term of "cultural dependent story" to represent the lists of links information in this way. Cultural dependent stories can bring separate facts in the right contexts for the end-user, and give a better view to the culture that the resources are describing. Furthermore, cultural heritages actually represent by the stories and often relate to other stories.

To reflect the values of cultural heritages according to this approach, Table 3.1 show the lists of example cultural aspects that used in this research.

Table 3.1 Example of Cultural Aspects and Definition

Cultural Aspect	**Definition**
Person	Persons and role in interacting with heritages such as creator, maintainer, owner, etc.
Object	Tangible cultural heritage items related to culture
Religion	Relation to religious teaching or tale of heritages
Folk-lore	Relation to a tale of heritages, may involve in supernatural phenomenon
Belief	Relation to common belief of heritages especially to mythical being
Ethnic	Relation to specific race or ethnic of people in the culture
Performing Art	Performances specific to locals
Local Wisdom	Special knowledge of specification passing down from generation
Architecture	Relation to specific style/pattern of tangible cultural heritages

Point of Interest can have the related Cultural Aspects in two ways. 1) Direct aspects: in this case, the concept that represents cultural aspects will have direct relation with Point of Interest. For example, Point of Interest living by Person (King Rama II), or Point of Interest exhibited Tangible Cultural Heritage Object (Buddha Mitsarat) or the place that commemorated of someone (Person). We classified the related aspects from this kind of relation as direct aspects. 2) Indirect aspects: Point of Interest acts as the container of cultural heritages. Not only Point of Interest, but cultural heritages also have to relate with other cultural related concepts. All type of cultural heritages also represents the values of culture in the form of cultural aspects. However, visitors consume the values of cultural heritage from the visited sites. For example (see Figure 3.3), If visitor interest in Wat Arun and Royal Palace; hidden relation about King Rama II can show to visitor. Without pre-knowledge of King Rama II, visitor can access this kind of hidden information by the proposed approach.

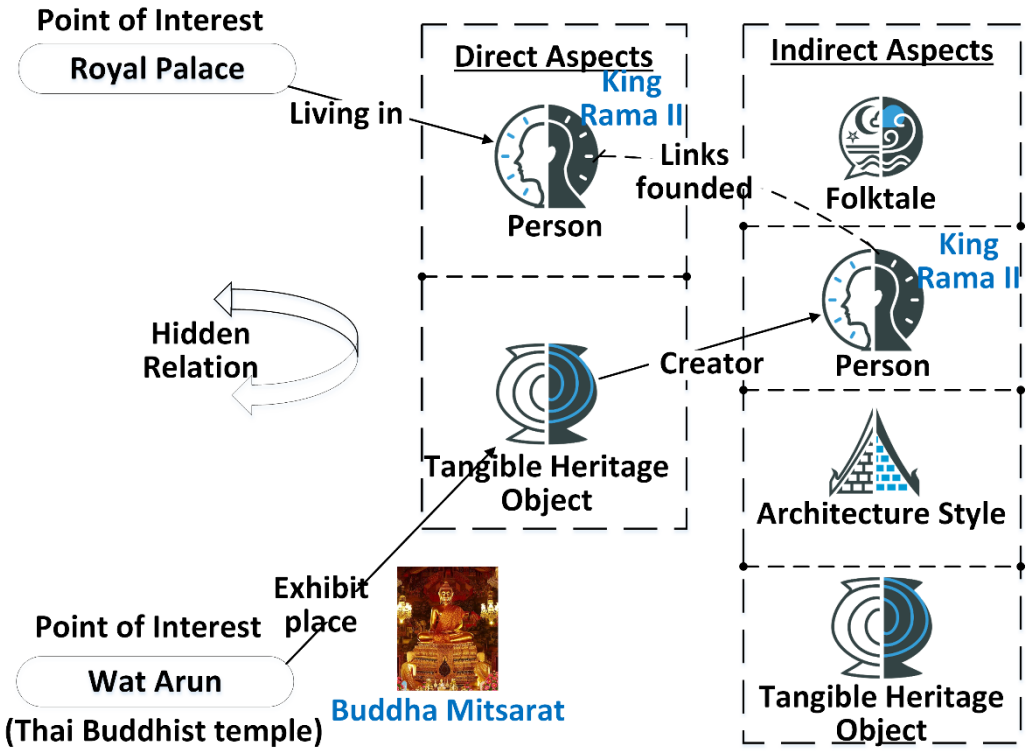

Figure 3.3 Hidden Relation thorough Aspects.

3.4 Design of Cultural Tourism Ontology

In this section, I will explain the design of cultural tourism ontology. The main contribution in this work is to classify cultural concepts (into cultural aspects) to reflect the values of destination culture. In this research, Ontology play the important role to provide rounded information of Cultural place and Heritages; in order to support visitor to create their own interest stories thorough the trip plan. Related information of the interested aspects will be retrieved via the mechanism of ontology from the related ontology concepts. According to three type of stories from Eric (2010), Traditional stories can classified as the intangible heritage (Folktale/Folklore) concept in Cultural Tourism Ontology structure. Visitor experience stories and Created stories can be created by the support information from recommender system. Possible interest aspects rounded the visited sites and heritages are provided as a choices for visitor to use as a material for their stories (as the trip plan).

In the designed ontology (see Figure 3.5), we can classify the concepts in to two group.

- *General concepts*: groups of upper-level concepts generic for every site.

- *Dependent concepts*: groups of concepts in leaf level specified to very concept of residing things depending to each tourist destination society. The current version contains concepts for case study, but it is opened to add more concepts to cover other instances.

In Cultural tourism ontology, the motivation of the design is to elaborate as much as detail information of cultural heritages in tourism site. A tourism site is the main concept of this ontology that contains all type of cultural heritages. The major concepts in this ontology are described below.

- *Cultural Points of Interest*: tourist consume the value of culture from the visited site, this concept is the main concept that links to other concepts and provide the detail information of the belonging cultural heritages via property relation (see Table 3.2).

Point of Interest has direct relation to person in three ways:

1) Founder relation: key person who involve in the role of creator of tourism site.
2) Lived at relation: person that live or used to live at the tourism site.
3) Symbolic: indicate that the place is the symbolic of person. For example, Wat Arun Temple is the symbolic temple (temple in honor) of King Rama II.

To describe the direct relation with physical object, the designed ontology provides the relation (*has_tangible_heritages*) to describe the object that exhibit in the site. For instance, Wat Phra Kaew is an individual of Point of Interest concept, and it has a cultural heritage object as Emerald Buddha, Ramayana Mural and Statue of Kinnara exhibit at the site.

Cultural Goods that including with *Cultural Product*, *Cultural Tourism Activity* (Permanent activities) and *Cultural Event* (Temporal/seasoning activities) are described by the relation of *has_cultural_produc*t, *has_cultural_tourism_activities* and *has_cultural_event* respectively. For example visitor can buy handicraft products (*Cultural Product*) at Bang Sai Royal Folk Arts and Crafts Centre, Tourist can enjoy Traditional Thai Massage service (*Cultural Tourism Activity*) at Wat Pho, in Nong Khai province (in Northeastern Thailand), Phon Phisai district area held Naga fireball festival (*Cultural_Event*).

In the real usage, Cultural Point of Interest can be used as the specific point of location such as Wat Phra Kaew or Wat Pho. In some case, the area such as Koh Kret communities and Phra Na Korn district area can be used. However, Point of Interest may contain other (sub) Point of Interest inside. The proposed ontology

does not allow this kind of structure (based on the defined relation in Table 3.2). It has to separate in to different tourism sites. For example, Ayutthaya historical park composes of a number of temples. To specify the details of each temple, the instance of Cultural Point of Interest should be separately prepared. If model the whole history park as the point of interest, information of each temple will be excluded. Tourism site can also be the religion place (the place of worship of religion), for example, Wat Phra Kaew is the Buddhist temple.

Another interesting component is Historical Event that held in the site. Without this component, information about person, object and ethnic in history cannot be identified. We can track to the past visit of the interesting person, object and ethnics by this design. For example, if visitor interesting Emeralds Buddha (*Tangible Cultural Object*) that exhibit in Wat Phra Kaew (Bangkok, Thailand), they can track to the past visit of emerald Buddha according to its traverse story (we will discuss more in the part of *Historical Event* concept).

- *Cultural Components*: this is top level concepts expanded to culture related concepts. This concept expands to the largest tree in this. The cultural component tree is split into two main levels as shown in Figure 3.5
    - Cultural Heritage: this concept is in generic level, and it refers to objects or thought originated in the past, passing from generation to generation.
        - *Tangible Cultural Heritage*: this concept represents physical things that reflect some aspects of social identity. It's classified in to *Building* and *Object*. Specific properties are assigned to link more details with person, intangible heritage and history event.

          Person can be linked as the creator, artist or the symbolic of tangible heritage. For example, Phra Phutthayotfa Chulalok Buddha statue created by King Rama III (*Cultural Person*); is a symbolic of King Rama I (*Cultural Person*).

          Visual Art Style, *Folk Wisdoms Knowledge*, *Folk Tale* and *Religion* are the concept to link *Tangible Cultural Heritage* to the deeper information according to the defined cultural aspects that we discussed in the previous section. These properties are the main key to link tangible heritages with the storyline to expand a viewpoint of visitors.

          Tangible Cultural Heritage also used as the symbolic of the event in history. For example, Victory Monument in Thailand is to remind the victory in the Franco-Thai War in 1941.

- *Intangible Cultural Heritage*: this concept represents non-physical heritages. *Folk Tales* (Folk-lore*), Folk Belief* and *Folk Wisdoms Knowledges* are the main concept of *Intangible Cultural Heritages* to represent cultural identity of destination. Visitor consumes value of intangible cultural heritages from the related concepts such as *Cultural Person*, *Tangible Cultural Heritage* and *Cultural Goods*. Visitor cannot have a direct interface with *Intangible Cultural Heritage* concept. However, this concept plays an important role to make each destination society unique and have its own identity. This concept can link *Tangible Cultural Heritage* and *Cultural Goods* to the deeper information according to defined cultural aspects.
    - *Folk Tale*: non-religious tale of heritages, may involve in supernatural phenomenon. Cultural Person or Tangible Cultural Heritage may be the main subject of this concept. In addition, Cultural Product, Cultural Event and Cultural Tourism Activity may relate to each other via the folktale. For example, Ramayana is the popular folklore. Lot of cultural heritages related to Ramayana such as Khon (Traditional Mask performing), Ramayana mural and Thotsakan statue at Wat Phra Kaew, Handicraft product related to Ramayana at Ban Khon Thai community.
    - *Visual Arts Style:* this concept represents the pattern/style of *Tangible Cultural Heritage* (*Building* and *Object*). Based on the provided information, it can be classified based on the era of art format (for instance, Ratanakosin style, Ayutthaya style or Sukhothai style) or specific style of pattern (for instance, Thai Yai style, Khmer style, Western style, etc.).
    - *Performing Art:* this is the important concept that represents the uniqueness of destination. Traditional dance and performance are the most popular show for visitor. In the design of ontology, *Cultural Point of Interest* can have direct relation with Performing Art. It's also have the relation via Cultural Event (because some traditional performing only shown in special event).
    - *Folk Wisdoms Knowledge:* specific knowledge that pass from generation. Visitor can learn and experience folk wisdoms knowledge via cultural tourism activities (such enjoy Thai Massage Service to have experience of Thai traditional massage wisdoms). *Cultural Product* and *Cultural Event* are other choice to observe and practice local knowledge of people.

- *Folk Belief:* this concept is very close to folklore (Folk Tale). Tradition (Ritual, activity according to the belief) is the key that we use to distinguish between Folk Belief and Folk Tale. Folk tale is just only the story without ritual according to the tale. If people create the activities to response the tale then it became the belief. For example, Loy Kratong Festival (Cultural Event) is an event that have the belief to pay respect to Phra Mae Kong Ka (God of Water).

- *Cultural Goods*: this concept refers to products made with intangible heritages or services for tourists to experience. The concept is not classified as the cultural heritages. However, this concept is an important tool to deliver cultural contents to visitor.
  - *Cultural Product:* represent physical products that reflect some cultural aspects. *Cultural Product* can link with *Performing Arts* and *Folk Wisdoms Knowledges* by the specific relations. For example Sin Tin Jok from Mae Jam district apply folk wisdoms knowledge of Traditional textile product, Handicraft products from Bang Sai Royal Folk Arts and Crafts Centre are the implementation of Handicraft folk wisdom knowledge.
  - *Cultural Tourist Activity:* is the simulated atmosphere of cultural activity that not depend on seasoning. Allow visitor to have experience with it. For example Long Neck Karen community that provides an atmosphere of Karen minority group living way of life, Thai Massage service in Wat Pho that provides traditional massage. Traditional Khuntoke Dinner to provide tradition Northern style of Thai foods. Thai Boxing shows that show traditional Thai martial arts.
  - *Cultural Event:* is the simulated atmosphere of cultural activity that depends on seasoning. Allow visitor to have experience with it. For example Songkran Festival at Khao San road, Poi Sang Long Festival in Maehongson province, Buffalo competition Festival in Chonburi province.

- *Cultural Person:* is the main actor of cultural related activities. As mention in *Cultural Point of Interest* concept, *Cultural Person* have direct relation with tourism site as the person who create (or founded) of the site, person who live at the site and person who act as the symbolic of the site. In the same ways, *Cultural Person* also link to *Tangible Cultural Heritage* as the person who create (*has_creator*), design (*has_artist*) or the person who act as the symbolic (*symbolic_person*) of *Tangible Cultural Heritage*. For example, Phra Phutthayotfa Chulalok Buddha statue (Tangible Cultural Heritage) created by King Rama III (*Cultural Person*); is a symbolic of King Rama I (*Cultural Person*).

- *Ethnic:* is the specific race or ethnic of people in the culture. This concept has related to tourism site by as the place of living (*lived_by)* and actor that involve in the event in history (*ethnics_actor)* at tourism site.
- *Historical Event:* is the concept to represent evident in history that may relate to *Tangible Cultural Heritages*, *Cultural Person* and *Ethnics* in the specific *Point Of Interest*. This concept will provide information that allow

To better understand of the usage scenario, let see the example representation of Cultural Point of Interest concept Figure 3.4. The instance is 'Wat Phra Kaew', one of the famous Thai temples. The ontology allows systematic assignment of cultural details explicitly. A cultural person relation shows that 'King Rama I' is a person involving in creating the temple. 'Emerald Buddha' heritage is located in the temple via a tangible cultural heritage relation. From 'Historical Event', it records that the temple held at 'Ordination ceremony of King Rama IX'. Hence, we can learn insightful detail of the temple with predefined relations and link instances to other instances systematically and semantically

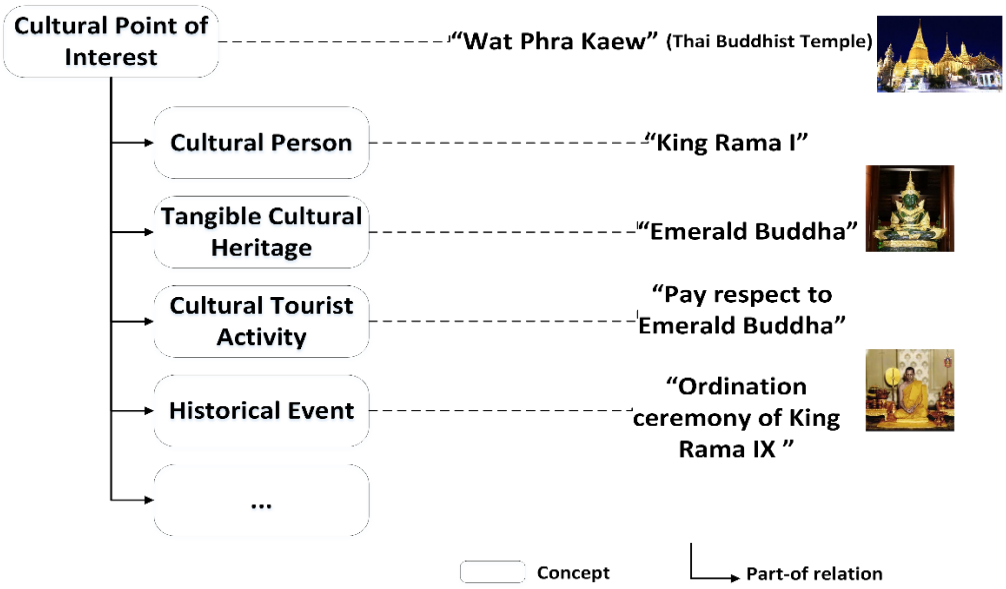

Figure 3.4 Example Representation of Cultural Point of Interest Concept

Aside from structural relations within the ontology, concept relations in Figure 3.6 shows that POI is a core of information in cultural aspects. The POI concept is a main class that gathers related details of cultural components in a view of tourists such as how a site is related to tangible cultural object, event, activity, and product and so on. Sometime, concepts are directly related to the POI concepts such as person in several roles such as resident and founder while a person can be related to POI via property of property such as person in an event occurred in the

site. However, in this ontology, a relation of class is not limited to POI, but it also shows that person can directly relate to tangible heritage too such as a person as a creator of the object. This ontology is carefully designed to cover these aspects in rational relations according to facts. Lastly, all the concepts are linked to the main class POI; hence, the highly important concept in this ontology is the POI concept that relates to every other classes. For more information about the key concepts, the output of Hozo design are shown in Appendix A.

Relation	Domain	Range	Definition
has_founder	Cultural Point of Interest	Cultural Person	key persons in the role of creator or founder of the site
has_tangible_heritages	Cultural Point of Interest	Tangible Cultural Heritage	tangible cultural heritages items that locate at the site
has_cultural_products	Cultural Point of Interest	Cultural Product	cultural products related to culture that sale at the site
has_cultural_events	Cultural Point of Interest	Cultural Event	temporal activity or festival that depends on seasoning
has_cultural_tourist_activities	Cultural Point of Interest	Cultural Tourist Activity	permanent activity that not depend on seasoning
lived_by	Cultural Point of Interest	Cultural Person	key persons that live at the site
lived_by_ethnics	Cultural Point of Interest	Ethnic	ethnic that live at the site
has_religion	Cultural Point of Interest, Cultural Event, Cultural Tourist Activity	Religion	indicate the related religion
symbolic_of_person	Cultural Point of Interest, Tangible Cultural Heritage	Cultural Person	symbolic person of the site or object
has_folk_tales	Cultural Point of Interest, Tangible Cultural Heritage, Cultural Goods	Folk Tale	related passing tales from generation
has_creator	Tangible Cultural Heritage	Cultural Person	key persons in the role of creator of tangible heritage
has_artist	Tangible Cultural Heritage	Cultural Person	key persons in the role of designer of tangible heritage
has_visual_art_style	Tangible Cultural Heritage	Visual Art Style	specific style/pattern of tangible heritage

represented_of_historical_events	Tangible Cultural Heritage	Historical Events	event in history that be commemorated by the tangible heritage
has_implemented_folkwisdoms_knowledges	Tangible Cultural Heritage, Cultural Product	Folk Wisdoms Knowledges	special knowledge of specification passing down from generation that implemented
sign_of_religion	Tangible Cultural Heritage	Religion	religion that the tangible heritage represent
has_provide_folk_wisdoms_knowledges	Cultural Event	Folk Wisdoms Knowledge	special knowledge of specification passing down from generation that show in cultural tourist activities and cultural events
has_performing_arts	Cultural Event	Performing Arts	traditional performing that show in cultural tourism activity or cultural events
has_actor	Historical Event	Cultural Person	Key persons in the role of actor in history event
has_action	Historical Event	Action	An action that actor perform in the history event
has_location_of_event	Historical Event	Cultural Point of Interest	The location of history event
has_subject_tangible_cultural_heritages	Historical Event	Tangible Cultural Heritage	An object involve in the history event
has_ethnic_actor	Historical Event	Ethnic	Ethnic that involve in the history event

Table 3.2 Properties relation and description

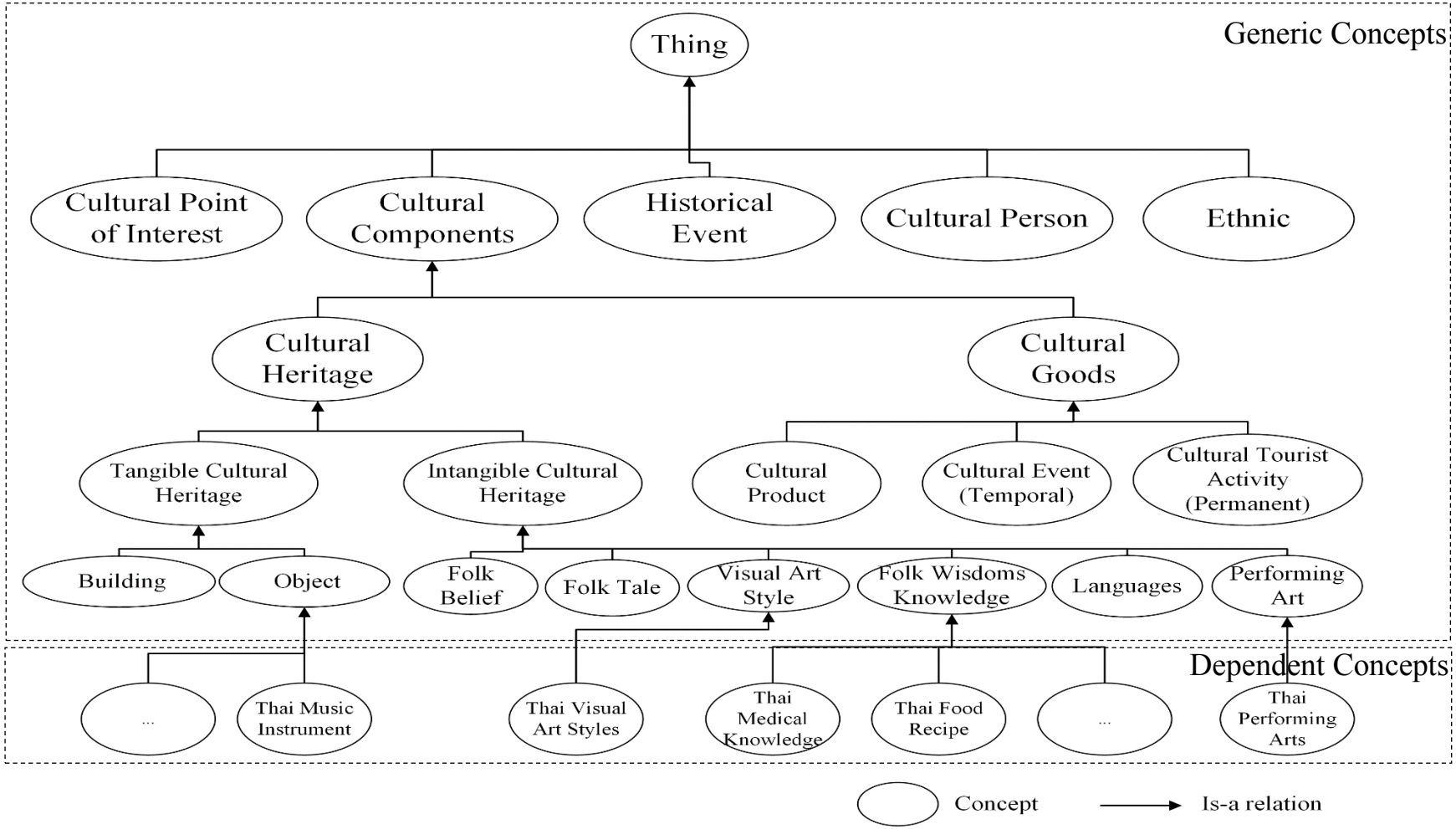

Figure 3.5 Cultural Tourism Ontology Structure

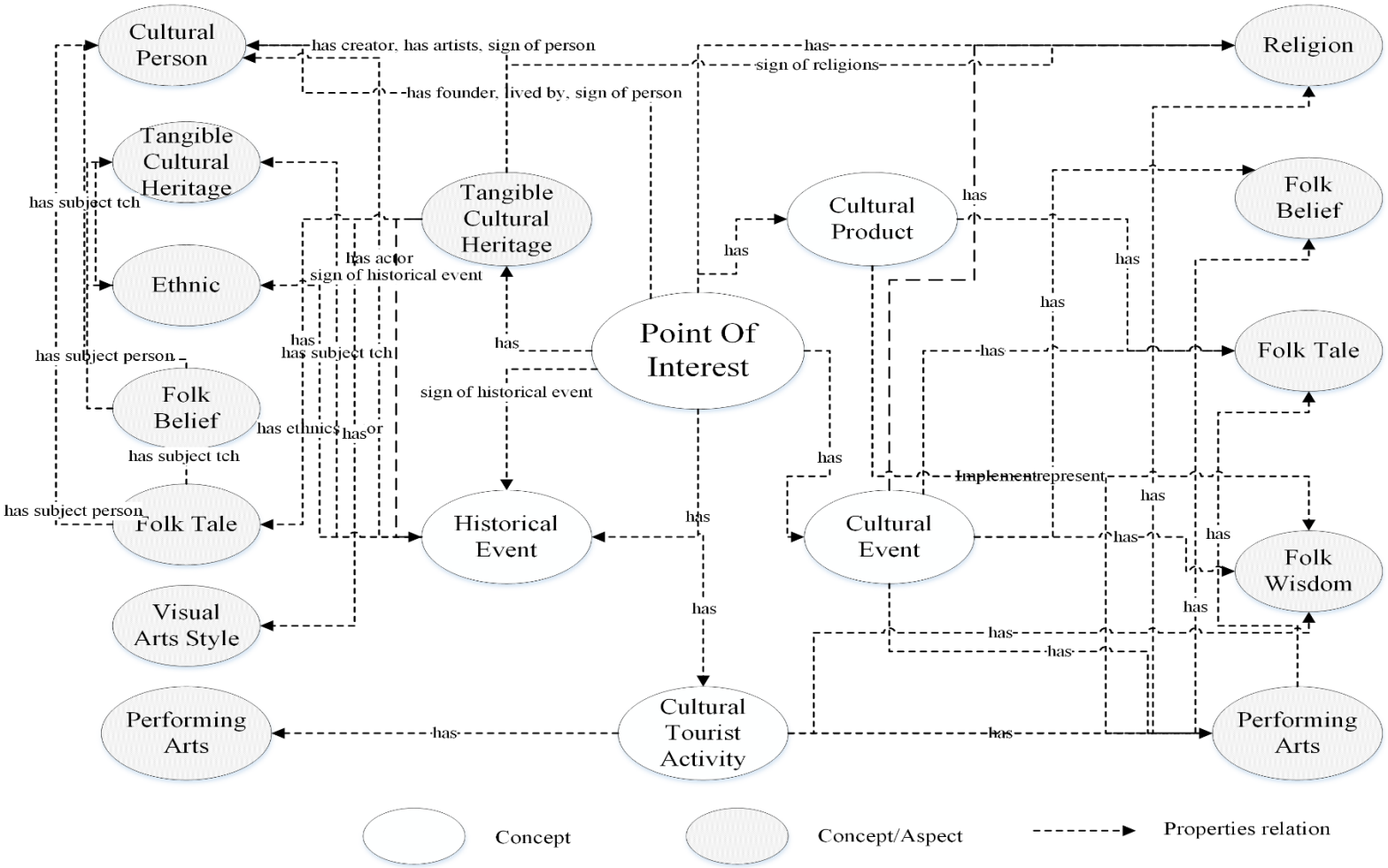

Figure 3.6 Relations of concepts in Ontology

3.5 Summary

This chapter discusses the design intention and the structure of Cultural Tourism. Specification and semantic meaning of major classes are also mentioned for clarifying ontology concepts and relations among them. By assuming that tourists learn value of cultural sites by visiting, a design of the ontology focused on cultural aspects involved in the sites. By ontology relations based on cultural aspects, tourists can view a hidden story linking a site to other sites. These ontology relations of cultural aspects are a key in a framework mentioned in the next chapter.

Chapter 4
Mixed Initiative Culture-based Tourism Framework

4.1 Introduction

This chapter discusses the detail of Mixed Initiative Culture-based Tourism Framework. First of all, I explain OAM framework that is used as the application interface to manage Cultural Tourism Ontology and the reliable source of cultural information for this research. Then, I carry on to a design of the proposed information services framework. The details of methods for identify possible interest cultural dependent stories and usage scenario of user are discussed. Finally, I explain the defined rules for cultural heritages concepts used in the framework.

4.2 System Overview

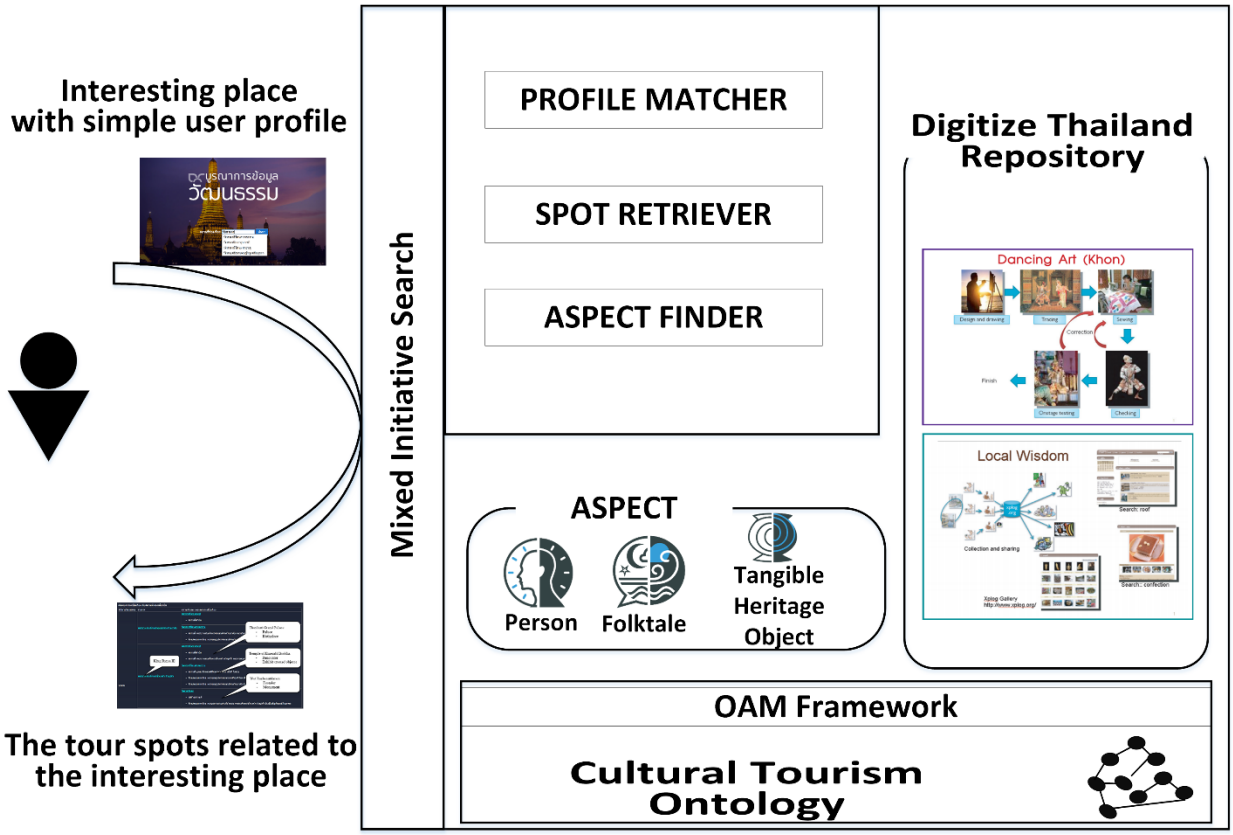

Figure 4.1 System Overview

According to figure 4.1, the system is designed to work in mixed initiative search. A user is asked to provide an interested tourist site to the system with no requirement of basic cultural knowledge

of the site. The system will find connection of heritages based on cultural aspects and return a list of sites culturally related to the initiated site. A user profile will be used to identify and scope cultural aspects. Results from the system can be freely and boundlessly browsed as farther as a user wants since all sites are connected with explicit cultural relation for at least one aspect to another.

The system consists of three main functions. The first function is Aspect Finder. This function is processed to find cultural aspect details based on the designed ontology from a tourist site. The second function is Spot Retriever which is responsible for finding tour sites from given aspects. It is used to connect a heritage to other heritages. The third function is Profile Matcher. This function includes a recording of a statistic of user search history and an analysis to identify user interest from search history. All of these functions work in cooperation with OAM framework (Buranarach et al., 2016) to bridge between the designed ontology and instances in database from repository.

4.3 Ontology Application Management Framework

Ontology Application Management Framework (OAM) (Buranarach et al., 2016) is an application development platform for ontology developer. OAM provide environment to support creation and adoption of an ontology-based Semantic Web application. Ontology application developer can benefit from OAM in two point. First, OAM provides data and application templates for different domain ontology. Second, OAM provide basic system for semantic search and recommender. Without modification needed, developer can provide service just after all configuration process are done. Development based on OAM, user can build an ontology-based application prototype through the graphic user interface. They claim that, programming skills are not required.

The OAM framework act as an intermediate layers between user application and Semantic Web programming & development environment. The design of the framework is based on three principles: manipulation, abstraction, and interoperability of an ontology data. Ontology is used as a central structure for publishing and accessing RDF data from the database. OAM will handle the difficulty of manage relational database and manipulate the RDF data. The layers which are introduced by OAM simplify the complexity of the underlying Semantic Web data standards and models. The framework is independent of the underlying implemented systems. Thus, wrapper architecture is required for interoperation with different data formats and systems.

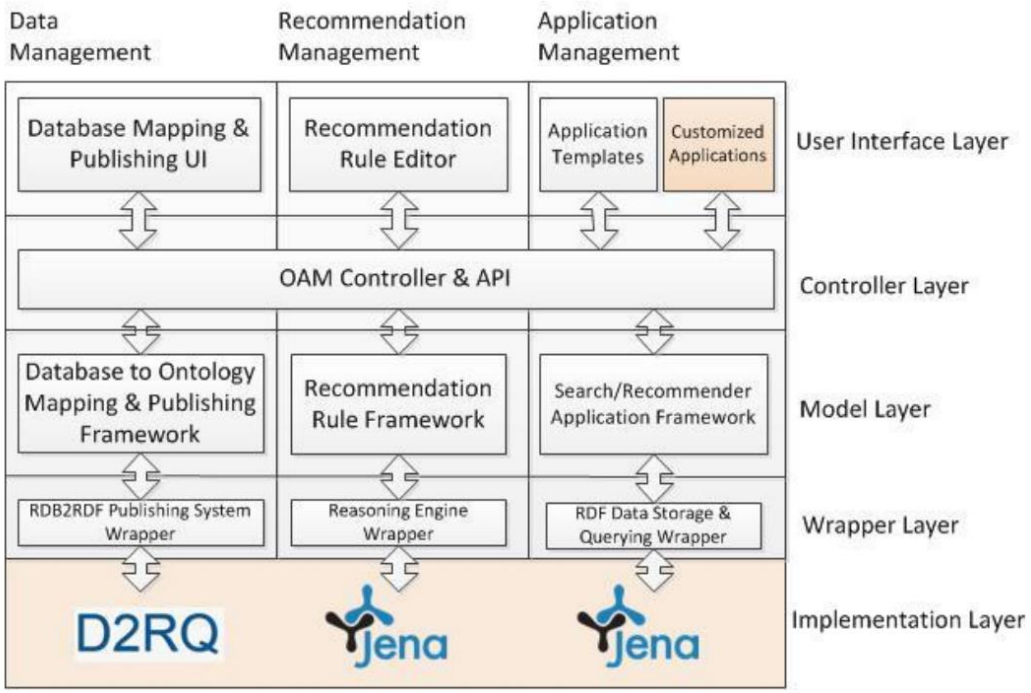

Figure 4.2 Lavered architecture of the OAM framework (Buranarach et al., 2016)

The framework is implemented on top of Semantic Web data and application platforms, using D2RQ (Bizer and Seaborne, 2004) to convert Relational Database in to RDF format. Jena's RDF data storage and Jena's reasoning engine (Apache Jena) are used as the low-level mechanism to provide inference service. Recommendation service and application template are provided on top of the framework. End user (Domain specialist) and system developer can also benefit with OAM framework. OAM also provides Java API to support an advanced application development.

In this work, OAM is exploited as to provide user interface for mapping ontology concepts and instances storing in database. In configuration, it allows to manually map database schema to ontology schema and also map vocabulary in searching for instances.

Figure 4.3 OAM interface in mapping instances to the ontology

With the help of OAM, the instantiation to the proposed ontology has been done with utmost accuracy. The instances and ontology schema will be used as a knowledge base in searching

and browsing related details in the further processes. As for obtaining data of cultural aspects, reliable tourism information from several open sites such as Culture Ministry and Digitized-Thailand project are gathered and extracted. The details are manually extracted into aspect-based details for the best accuracy since its accurate information will directly effect on the overall performance of the searching result. An example of text-based data from the source is given in Figure 4.4.

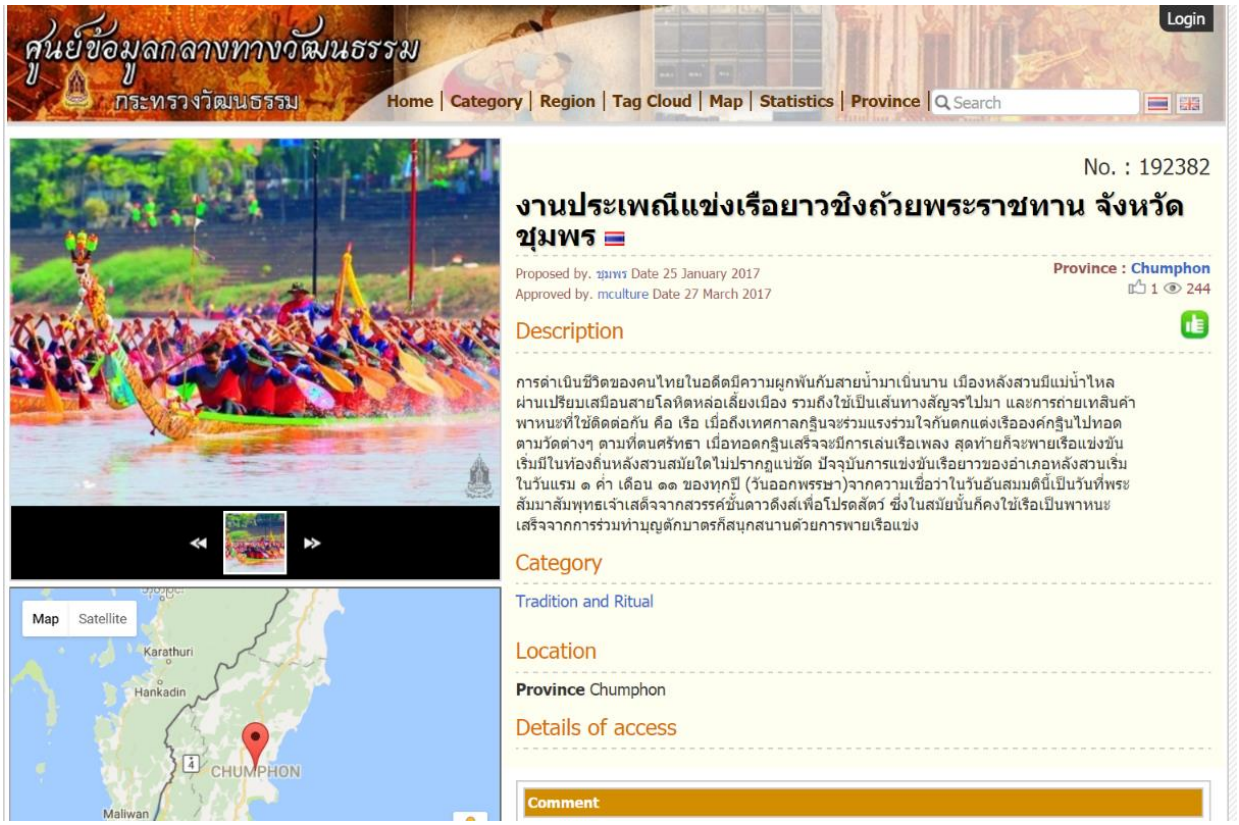

Figure 4.4. Textual data for the source of instances

4.4 Mixed Initiative Culture-based Tourism Framework

Mixed Initiative Culture-based Tourism Framework has been developed using OAM framework and the proposed Cultural Tourism Ontology. By the assumption that tourists have personally held of their belief, values, assumptions, and the way they view the world. Tourists may lack prior knowledge about destination in cultural aspects. It is difficult for them to get the new insights and understandings of the destination according to the values of culture. The proposed framework aims to overcome these problems. Tourists (site visitors) are focused as the system users. Users and the system will collaborate in a mixed-initiative fashion, and each contributes what one does best. In particular, users are allowed to keep control of the interaction and to inform detail and select their interest among choices while the system provides the relevant information by offering easy ways to explore the options without the need to specify and modify the information search. This can enable users to access as much information and explanations as they

prefer. Furthermore, it can also help to promote the hidden value of heritages and motivate to learn more of the related heritages since they learnt some insight details.

An overall architecture of the system is drawn in Figure 4.5, the system composes of 3 parts.

- Searching related details from user query
- Expanding details to related instances
- Scoping searching results with user's history

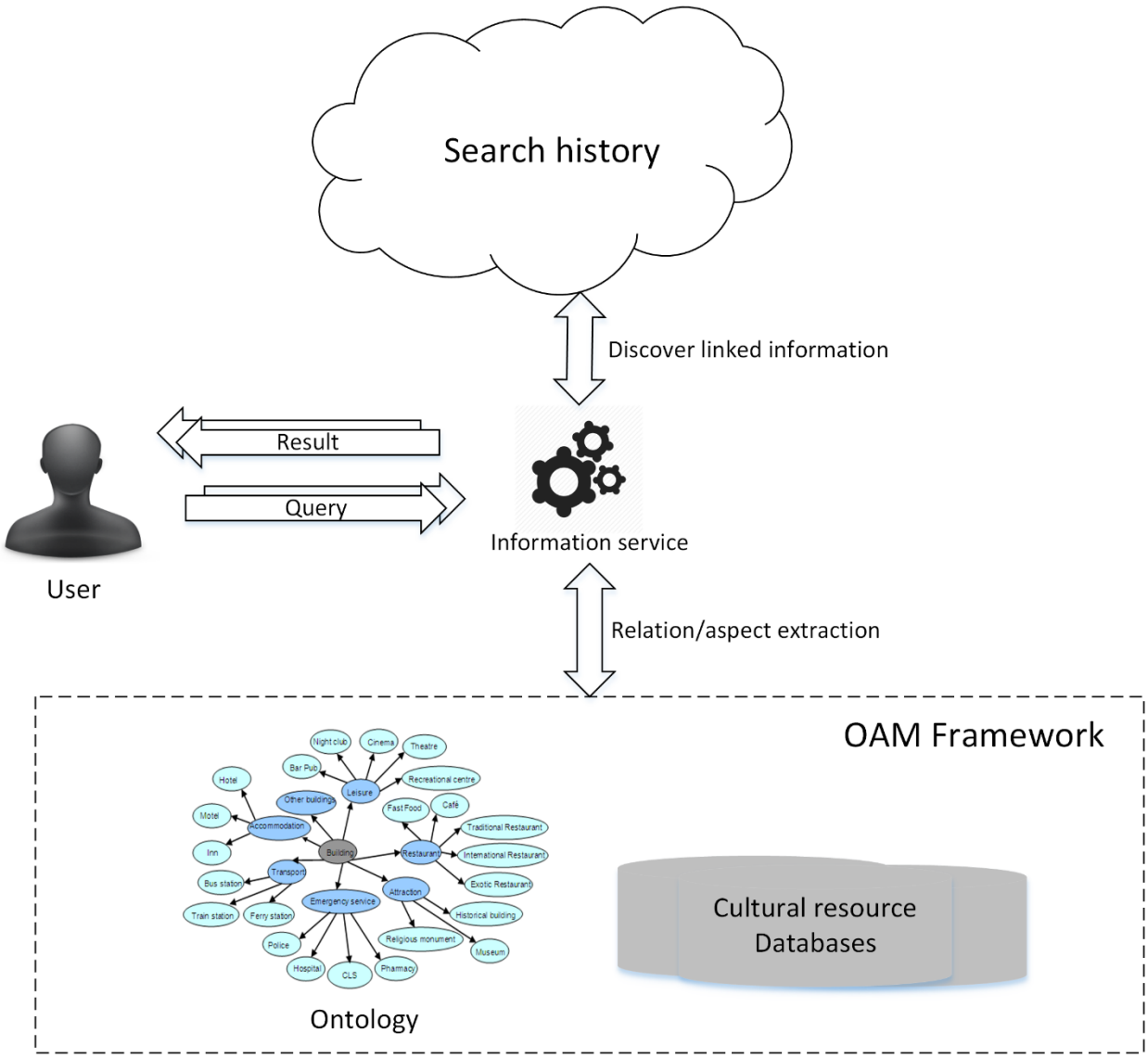

Figure 4.5 System Architecture

4.4.1 Searching related details from user query

The search in this work is in mixed initiative fashion meaning that users are asked to make a query once and the knowledge will guide through the rest for providing all related options based on the query. For the initial state of searching process, users are asked to input one of the site they are interested. To assist users, a function to fill the rest of the word based on existing site instances is available.

Once a user provides a site, the system will find all related instances to the site based on cultural aspects given in ontology. The result will be a list of related instances such as persons, objects and tales involved to the site with comprehensible relation name. For example, information such as a founder of a site will be given, and attractive items in the site will be provided. The found instances will be grouped based on the design of ontology classes; hence, persons involved in the site, for example, will be grouped together. The concept of searching is sketched in Figure 4.6

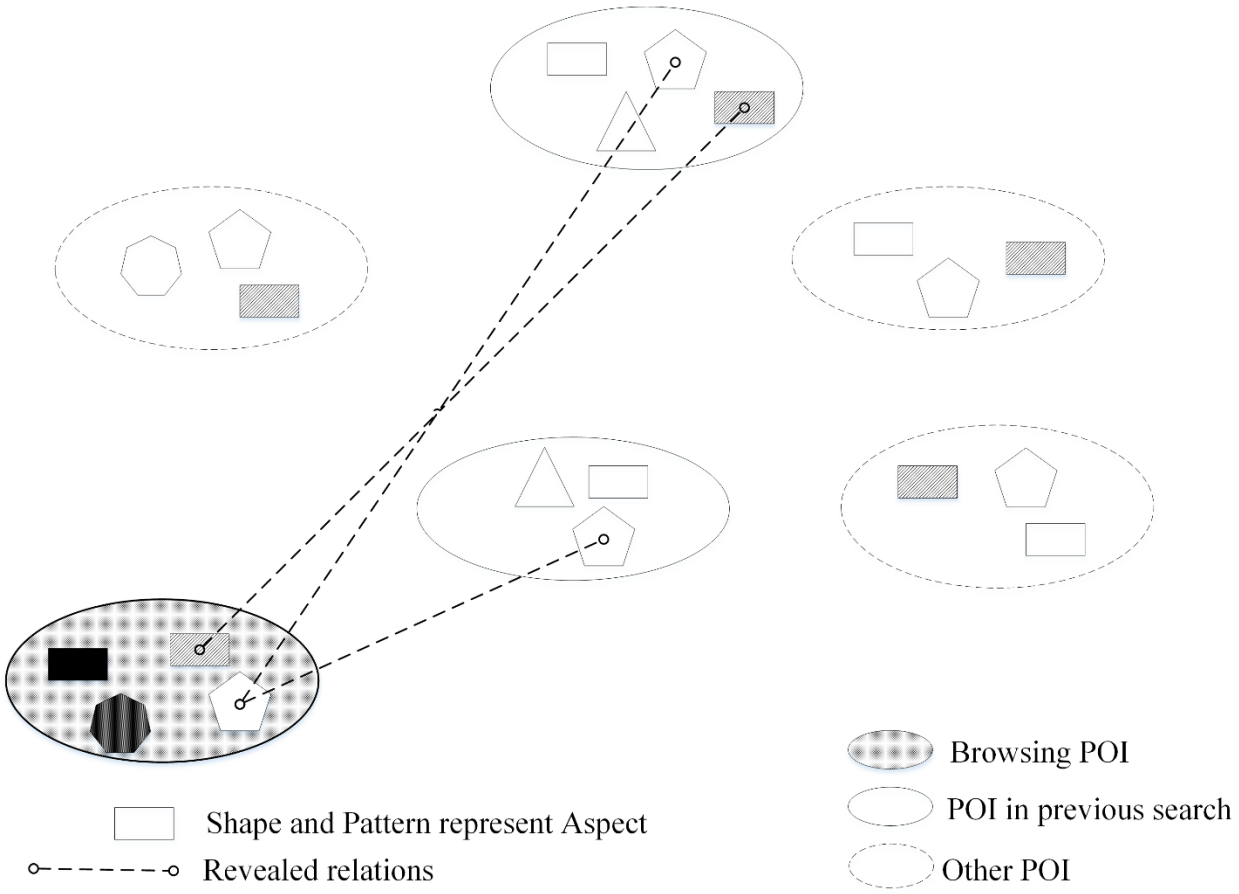

Figure 4.6 A concept of searching related details from user query based on a relation given in the ontology

For better understanding, let me provide a scenario example. A user filled in for tourist site as Wat Phra Kaew and the system will run through ontology structures of this instance. It will find relations as has_founder, has_historical event, has_tangible_cultural_heritages, has_cultural_event, etc. Then, the instances related to the queried instance will be retrieved with relation description such as King Rama I (as the founder), Emerald Buddha (as exhibit object), Ramayana mural (as exhibit object) and King Rama IX ordination (history event at the site). The found result will be grouped together; for example, the Person part will include King Rama I and King Rama IX while the Object part will show a list of Emerald Buddha and Ramayana mural.

Moreover, the queries made by users will be recorded as a personal log (if they made a registration and logged in with their account) for further usage. In the current status, available queries are limited to the site instances mapped the ontology.

4.4.2 Expanding more details

In this process, the involved instances from the previous process will be accounted for detail expansion. Based on the prior knowledge from the designed ontology, all instances will be expanded regarding to assigned properties to create a link to other sites and cultural heritages.

For example, ‘King Rama I’ has his own details such as his birth place, his living place, other sites that he has found and his work on heritage items. Hence, several cultural sites can be linked for the previously exemplified query through his presence. In this process, there is not a limit to only cultural sites but all type of heritages. Therefore, the found relation will not only point out to other sites, but also include the tale related to his majesty and objects his majesty involved in the event such as a Buddha statue made by his majesty and a poet he wrote.

With this process, users can browse through the related concepts freely without a necessity of having the background knowledge. The linking of heritage instances is counted as a dependent story based on their point of interest (POI). A sketch of conceptual browsing paths connecting via the common in instances is given in Figure 4.7.

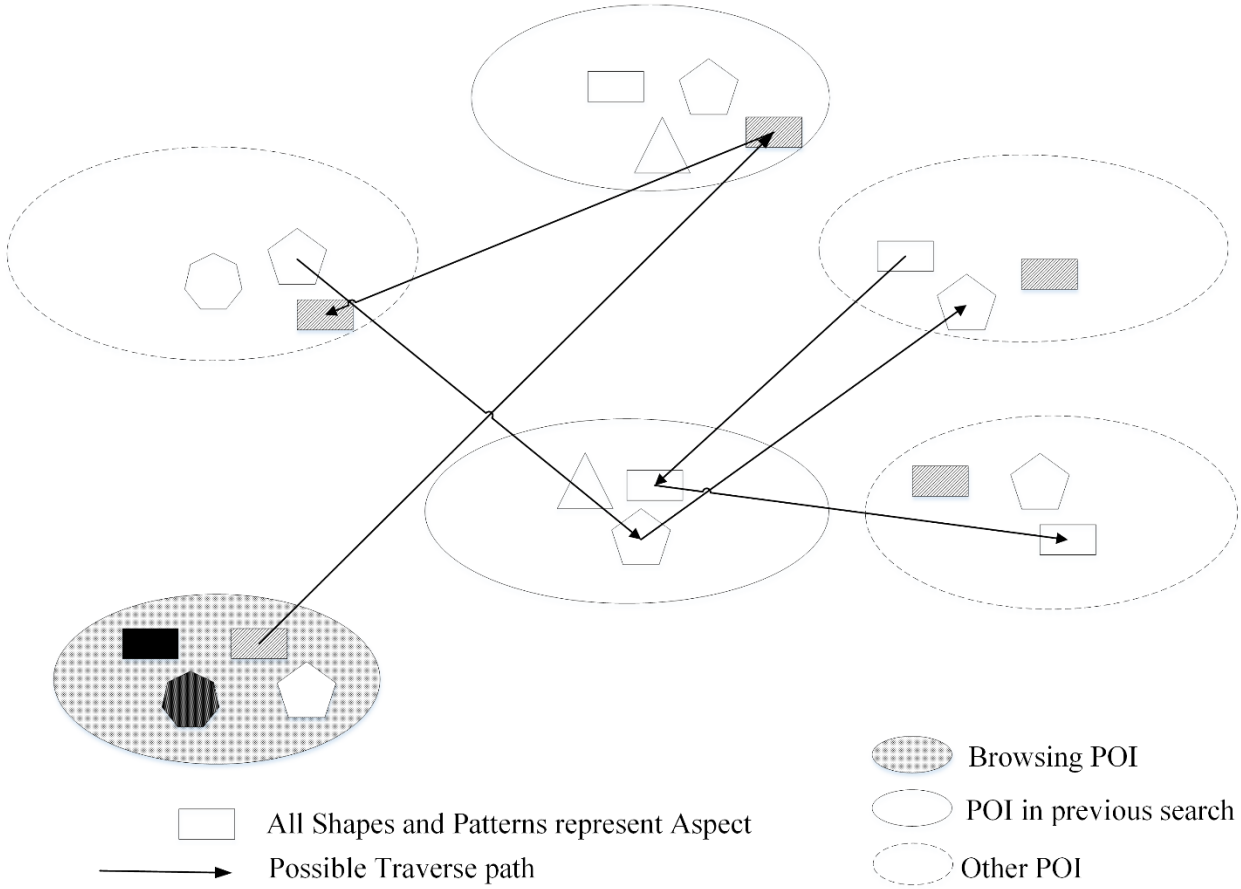

Figure 4.7. A concept of browsing in the system through POI via common details of instances

An exemplified searching result to link another sites based on Person aspect is given in Figure 4.8. From this example, King Rama III has been focused as a Person aspect related to the first query, and the system found that his majesty involved to several other sites such as Thonburi Grand palace as his majesty birthplace and resident site. Furthermore, his majesty also gave an order to renovate the Temple of Emerald Buddha. Lastly, his majesty monument is located in a Wat Rachanatdaram (Buddhist temple) that was found by him. From the example, users can see a story behind the tourist sites that they may not know before. This story will urge them to find more value in cultural and historical view based on their point of interest. Moreover, if the users are a person who enjoys a cultural aspects related to his majesty King Rama III, this generated information will push him/her the desire to visit given sites from the implicit connection of heritages and story.

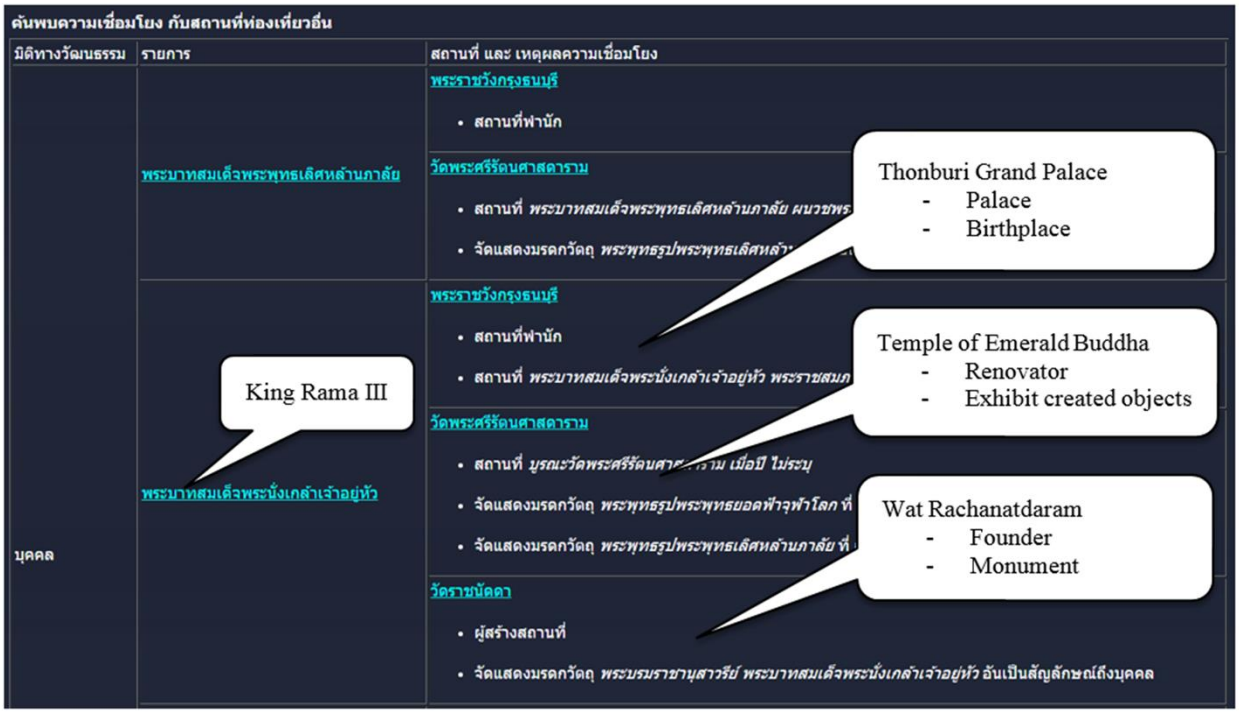

Figure 4.8. Example Screen Result

4.4.3 Scoping users' point of interest

In practical usage, a lot of possible instances from linking can be vastly numerous and lead to confusion in navigation. A history log of query made by a user from the previous searching can help to notify their preferable view. In this process, a record of previous search queries will be used to generate a list of aspects user prefers.

Based on the assumption that users may often search for a site containing one of their interests, the POI of the queries can be counted and calculated from commonness for top-five preferable POIs. For example, a user, who often searched for sites containing a famous Buddha statue, can be concluded that this user is a fan of Buddha statues and likely wants to visit another site with famous Religious heritages.

With the assumption, the preferable POIs are used to scope the generated result to fit users individually. The process is activated in newly input query to prevent a flood of searching results since in this work many of POIs are designed in the ontology to increase a coverage of aspects as many as possible.

4.5 Rule to Extract Cultural Aspect (Aspect Finder)

In searching and linking instances, a predefined rule is used to retrieve related concepts based on the relations in the ontology. These rules are carefully designed into sets based on cultutal aspects as Cultural Person, Ethnic, Tangible Cultural Heritage and Religion concept. By the use of

inference engine via OAM, rules can retrieve involved instances based on the designated relations. The rules can be separated into two sets based on complexity in retrieving.

4.5.1 Rule set for direct retrieving

In this part, rules for retrieving related instances that can be directly obtained from a property of a site instance are listed with definition.

1. Rule to retrieve a person instance related to a site instance on resident in relation: a person who used to live in a site

```
[ Rule-01: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_lived_by ?v0) (?instance2 rdf:type ns:Cultural_Persons) (?instance2
ns:has_id ?v0c0) (?v0 ns:has_id ?v0c0) -> (?instance1
ns:has_rec_cultural_person_aspects ?instance2) ]
```

2. Rule to retrieve a person instance related to a site instance on symbolic relation: a person who relates to a site as symbol

```
[ Rule-02: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_sign_of_cultural_person ?v0) (?instance2 rdf:type
ns:Cultural_Persons) (?instance2 ns:has_id ?v0c0) (?v0 ns:has_id ?v0c0) ->
(?instance1 ns:has_rec_cultural_person_aspects ?instance2) ]
```

3. Rule to retrieve a person instance related to a site instance on founder relation: a person who established a site

```
[ Rule-03: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_founder ?v0) (?instance2 rdf:type ns:Cultural_Persons) (?instance2
ns:has_id ?v0c0) (?v0 ns:has_id ?v0c0) -> (?instance1
ns:has_rec_cultural_person_aspects ?instance2) ]
```

4. Rule to retrieve ethnic of people related to a site instance: an ethnic of people resides in a site

```
[ Rule-04: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_lived_by_ethnics ?v0) (?instance2 rdf:type ns:Ethnics) (?instance2
ns:has_id ?v0c0) (?v0 ns:has_id ?v0c0) -> (?instance1
ns:has_rec_ethnics_aspects ?instance2) ]
```

5. Rule to retrieve an object instance related to a site instance with has_tangible_heritages relation: an object that belongs to or is displayed in a site

```
[ Rule-05: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_tangible_heritages ?v0) (?instance2 rdf:type
ns:Tangible_Cultural_Heritages) (?instance2 ns:has_ca_id ?v0c0) (?v0
ns:has_ca_id ?v0c0) -> (?instance1 ns:has_rec_tch_aspects ?instance2) ]
```

6. Rule to retrieve an instance related to a site instance with has_religions relation: a religion of an instance

```
[ Rule-06: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_religions ?v0) (?instance2 rdf:type ns:Religions) (?instance2
ns:has_id ?v0c0) (?v0 ns:has_id ?v0c0) -> (?instance1
ns:has_rec_religions_aspects ?instance2) ]
```

These 6 rules are designed to directly work with site instances. Although some of the site instances may lack some properties to these aspects such as a palace may exclude the properties of ethnic and religion, or a temple may not contain a detail about residents. With inference engine, the retrieved instances will be kept in an ontological aspect relation of the POI concept as:

- has_rec_cultural_person_aspects (rule1,2,3 : Person aspect)
- has_rec_ethnics_aspects (rule4 : Ethnic aspect)
- has_rec_tch_aspects (rule5 : Tangible Object aspect)
- has_rec_religion_aspects (rule6 : Religion aspect)

These rules are the key in Searching related details from user query process mentioned in Section 4.4.1.

4.5.2 Rule set for indirect retrieving

An indirect aspect is a linking of property of property to the site instance. To retrieve indirect aspects, a complex rule of referring concept via a property of main concepts is needed. In this part, a list of indirect rules is provided with definition.

7. Rule to retrieve a person instance related to an event occurred in a site instance: a person in an event in a site – 2 leveled linking a person to a site from an event. The found instance will be collected in *Person* aspect of *POI*.

```
[ Rule-07: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_rec_historical_events ?v0c0) (?instance2 rdf:type ns:Historical_Events)
(?instance2 ns:has_actor ?v0) (?instance3 rdf:type ns:Cultural_Persons) (?instance3
ns:has_id ?v1) (?v0c0 ns:has_actor ?v0) (?v0 ns:has_id ?v1) -> (?instance1
ns:has_rec_cultural_person_aspects ?instance3) ]
```

8. Rule to retrieve an object instance related to historical event occurred in a site instance: an object in an event in a site – 2 leveled linking a tangible heritage to a site from a historical event. This can also lead to a place where an object used to be or currently is to form a story of an object. The found instance will be kept in *tangible heritage* relation of *POI*.

[Rule-08: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_rec_historical_events ?v0c0) (?instance2 rdf:type ns:Historical_Events) (?instance2 ns:has_tangible_cultural_heritages ?v0) (?instance3 rdf:type ns:Tangible_Cultural_Heritages) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_tangible_cultural_heritages ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_tch_aspects ?instance3)]

9. Rule to retrieve an instance related to an activity occurred in a site instance: 2 leveled linking a religion concept to a site from an activity. The found instance will be kept in *Religion* relation of *POI*.

[Rule-09: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_tourist_activities ?v0c0) (?instance2 rdf:type ns:Cultural_Tourist_Activities) (?instance2 ns:has_religions ?v0) (?instance3 rdf:type ns:Religions) (?instance3 ns:has_id ?v1) (?v0c0 ns:has_religions ?v0) (?v0 ns:has_id ?v1) -> (?instance1 ns:has_rec_religions_aspects ?instance3)]

10. Rule to retrieve an instance related to an event occurred in a site instance: 2 leveled linking a religion concept to a site from an event. The found instance will be kept in *Religion* relation of *POI*.

[Rule-10: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_events ?v0c0) (?instance2 rdf:type ns:Cultural_Events) (?instance2 ns:has_religions ?v0) (?instance3 rdf:type ns:Religions) (?instance3 ns:has_id ?v1) (?v0c0 ns:has_religions ?v0) (?v0 ns:has_id ?v1) -> (?instance1 ns:has_rec_religions_aspects ?instance3)]

11. Rule to retrieve a folktale instance related to an event occurred in a site instance: 2 leveled linking a folktale concept to a site from an event. This is for the festival tourist site where the traditional event is related to the folktale. The found instance will be kept in *folktale* relation of *POI*.

```
[ Rule-11: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_cultural_events ?v0c0) (?instance2 rdf:type ns:Cultural_Events)
(?instance2 ns:has_ca_folk_tales ?v0) (?instance3 rdf:type ns:Folk_Tales)
(?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_ca_folk_tales ?v0) (?v0
ns:has_ca_id ?v1)  -> (?instance1 ns:has_rec_folk_tales_aspects ?instance3) ]
```

12. Rule to retrieve a folktale instance related to an activty occurred in a site instance: 2 leveled linking a folktale concept to a site from an event. This is for the festival tourist site where the traditional activy is related to the folktale. The found instance will be kept in *folktale* relation of *POI*.

```
[ Rule-12: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_cultural_tourist_activities ?v0c0) (?instance2 rdf:type
ns:Cultural_Tourist_Activities) (?instance2 ns:has_ca_folk_tales ?v0) (?instance3
rdf:type ns:Folk_Tales) (?instance3 ns:has_ca_id ?v1) (?v0c0
ns:has_ca_folk_tales ?v0) (?v0 ns:has_ca_id ?v1)  -> (?instance1
ns:has_rec_folk_tales_aspects ?instance3) ]
```

13. Rule to retrieve a folktale instance related to a product sold in a site instance: 2 leveled linking a folktale concept to a site from a cultural product. This is for the tourist site where sell a traditional products related to the folktale. The found instance will be kept in *folktale* relation of *POI*.

```
[ Rule-13: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_cultural_products ?v0c0) (?instance2 rdf:type ns:Cultural_Products)
(?instance2 ns:has_ca_folk_tales ?v0) (?instance3 rdf:type ns:Folk_Tales)
(?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_ca_folk_tales ?v0) (?v0
ns:has_ca_id ?v1)  -> (?instance1 ns:has_rec_folk_tales_aspects ?instance3) ]
```

14. Rule to retrieve a folktale instance related to an object belongs to a site instance: 2 leveled linking a folktale concept to a site from an object. This is for the tourist site where the famous sightseeing object is related to a specific folktale. The found instance will be kept in *folktale* relation of *POI*.

[Rule-14: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_tangible_heritages ?v0c0) (?instance2 rdf:type ns:Tangible_Cultural_Heritages) (?instance2 ns:has_folk_tales ?v0) (?instance3 rdf:type ns:Folk_Tales) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_folk_tales ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_folk_tales_aspects ?instance3)]

15-16. Rule to retrieve a belief instance related to an event and activity setting in a site instance: 2 leveled linking a belief concept to a site from an event. This is for the tourist site where sets up an event or activity related to a specific belief. The found instance will be kept in *Belief* relation of *POI*.

[Rule-15: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_events ?v0c0) (?instance2 rdf:type ns:Cultural_Events) (?instance2 ns:has_folk_belief ?v0) (?instance3 rdf:type ns:Folk_Belief) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_folk_belief ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_folk_belief_aspects ?instance3)]

[Rule-16: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_tourist_activities ?v0c0) (?instance2 rdf:type ns:Cultural_Tourist_Activities) (?instance2 ns:has_folk_belief ?v0) (?instance3 rdf:type ns:Folk_Belief) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_folk_belief ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_folk_belief_aspects ?instance3)]

17. Rule to retrieve an ethnic instance related to a historical event occurred in a site instance: 2 leveled linking an ethnic of people to a site from a past event. This is for the tourist site where there was an event related to a specific ethnic of people. The found instance will be kept in *Ethnic* relation of *POI*.

[Rule-17: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_rec_historical_events ?v0c0) (?instance2 rdf:type ns:Historical_Events) (?instance2 ns:has_ethnics_actor ?v0) (?instance3 rdf:type ns:Ethnics) (?instance3 ns:has_id ?v1) (?v0c0 ns:has_ethnics_actor ?v0) (?v0 ns:has_id ?v1) -> (?instance1 ns:has_rec_ethnics_aspects ?instance3)]

18-19. Rule to retrieve a performing art instance related to an event or activity setting in a site instance: 2 leveled linking a performing art concept to a site from an event. This is for the

tourist site where sets up a show. The found instance will be kept in *Performing_art* relation of *POI*.

[Rule-18: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_events ?v0c0) (?instance2 rdf:type ns:Cultural_Events) (?instance2 ns:has_performing_arts ?v0) (?instance3 rdf:type ns:Performing_Arts) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_performing_arts ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_performing_arts_aspects ?instance3)]

[Rule-19: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_tourist_activities ?v0c0) (?instance2 rdf:type ns:Cultural_Tourist_Activities) (?instance2 ns:has_performing_arts ?v0) (?instance3 rdf:type ns:Performing_Arts) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_performing_arts ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_performing_arts_aspects ?instance3)]

21-22-23. Rule to retrieve a folk wisdom instance related to an event/activity setting in or a product sold in a site instance: 2 leveled linking a folk wisdom concept to a site from an event. This is for the tourist site where sets up an event/activy or sells products related to a specific wisdom. The found instance will be kept in *Folk_Wisdom* relation of *POI*.

[Rule-21: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_events ?v0c0) (?instance2 rdf:type ns:Cultural_Events) (?instance2 ns:has_folk_wisdoms ?v0) (?instance3 rdf:type ns:Folk_Wisdoms_Knowledges) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_folk_wisdoms ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_folk_wisdoms_aspects ?instance3)]

[Rule-22: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1 ns:has_cultural_products ?v0c0) (?instance2 rdf:type ns:Cultural_Products) (?instance2 ns:has_implemented_folk_wisdoms_knowledges ?v0) (?instance3 rdf:type ns:Folk_Wisdoms_Knowledges) (?instance3 ns:has_ca_id ?v1) (?v0c0 ns:has_implemented_folk_wisdoms_knowledges ?v0) (?v0 ns:has_ca_id ?v1) -> (?instance1 ns:has_rec_folk_wisdoms_aspects ?instance3)]

```
[ Rule-23: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_cultural_tourist_activities ?v0c0) (?instance2 rdf:type
ns:Cultural_Tourist_Activities) (?instance2
ns:has_provide_folk_wisdoms_knowledges ?v0) (?instance3 rdf:type
ns:Folk_Wisdoms_Knowledges) (?instance3 ns:has_ca_id ?v1) (?v0c0
ns:has_provide_folk_wisdoms_knowledges ?v0) (?v0 ns:has_ca_id ?v1)  ->
(?instance1 ns:has_rec_folk_wisdoms_aspects ?instance3) ]
```

24. Rule to retrieve a Visual Art Style instance related to an object showed in a site instance: 2 leveled linking a Visual Art Style concept to a site from an object. This is for the tourist site where sets up a show. The found instance will be kept in *Visual Art Style* relation of *POI*.

```
[ Rule-24: (?instance1 rdf:type ns:Point_Of_Interest) (?instance1
ns:has_tangible_heritages ?v0c0) (?instance2 rdf:type
ns:Tangible_Cultural_Heritages) (?instance2 ns:has_visual_arts_styles ?v0)
(?instance3 rdf:type ns:Visual_Arts_Styles) (?instance3 ns:has_ca_id ?v1) (?v0c0
ns:has_visual_arts_styles ?v0) (?v0 ns:has_ca_id ?v1)  -> (?instance1
ns:has_rec_visual_arts_aspects ?instance3) ]
```

The rules are for searching and linking all the instances to the query in helping expansion for browsing. Moreover, to make browsing smooth, a reverse relation is also needed as shown in rule 25.

```
[ Rule-25: (?instance1 rdf:type ns:Cultural_Persons) (?instance1 ns:has_id
?v0c0) (?instance2 rdf:type ns:Point_Of_Interest) (?instance2 ns:has_lived_by
?v0) (?v0 ns:has_id ?v0c0) -> (?instance1
ns:has_rec_point_of_interest_by_lived_at ?instance2) ]
```

4.6 Summary

In this chapter, the proposed framework is explained with the method and rules used in achieving a result. The input of the system is a site query from a user. The system will generate a list of related instances related by the ontology for a user to view a relation of heritage site by linking common properties. User search history is used to determine user's preference in searching. The linked sites can be browsed freely by a user.

Chapter 5
Experiment and result

5.1 Introduction

In this chapter, a detail of an experiment is explained including experiment setting, hypothesis and results. The experiment is conducted to show the potential of the systems in use by random subjects. An analysis, comparison and discussion of the result are provided and concluded in this chapter.

5.2 Experiment Setting

In this experiment, despite the lack of background knowledge of visitor. I aim to evaluate the result of the system that support open visitor's eye to new (unfamiliar) cultural tourist sites. By analyze result of cultural planning before and after used the system.

To evaluate usability of the proposed system, we set up an experiment as follow. Subjects in experiment are queried with the background of their tourist knowledge to analyze, compare and conclude the gain of using the system. We asked 60 Thai persons as samples to use the system. The volunteered samples are a working person. We are interested in the potential of traveling based on their income (touring for relaxation) and opportunity for business trip. We separated subjects into three groups. All subjects were asked to make a tourist plan and be a cultural tourist guide in Thailand for 2 days for their foreigner friends who never come to Thailand. For instance data, 143 famous sites in Thailand were manually instantiated for the best quality. We selected these 143 sites based on the searching amounts for more than 1,000 times from search engine. The sites include temples, palaces, museums, cultural villages opened for tourists and areas holding festivals. These instances are a list for subjects to select from and made a tourist plan. Subjects were asked to make at least 3 sites and at most 5 sites to visit per day.

For a better understanding on usage setting in this experiment, an instruction of tasks in step-wise as an electronic handout file was provided to all participants. The handout was given to participants for at least 3 days before the experiment time via email, and participants were asked to reply as a notification of receiving. For a record, all participants replied within a day after a delivery of the handout while 5 participants also asked to confirm instructions. In details, all participants were asked to make a tourist plan and be a cultural tourist guide in Thailand for 2 days for their foreigner friends who never come to Thailand. The plan is a list of sites they would take friends to visit without concerning on cost, distance, transportation availability and time constraints.

For the initial process, all subjects were asked to make a plan without the help of system within an hour allotted time. Once the first plan was done, they were asked to use the system to adjust the plan. We split subjects into three groups for 20 subjects each into difference of information given level. According to Table 5.1, the first group (can be compared as non-user) that

can access the overview/surface level of information and we used them as the baseline of the experiment. The second group was provided with the aspect information level that provided an expanding version of information with common instances. Subject in this group do not need to analyze all information by themselves. The last group was given with knowledge level with profile including all generated detail and common instances with specification to commonness storing in users' profile (search history). Before and after using the system, all subjects were asked to answer pre-used questionnaire and post-used questionnaire respectively.

Table 5.1. Level of Information Generation

Level of Information Generation	**Details**
General Information Level	Tourist sites which directly matched to the user's query; including direct related classes from object properties and data from data properties.
Aspect Information Level	Details of tourist sites and its aspect detail; including with direct and indirect aspects according to the designed Cultural Tourism Ontology.
Knowledge Level & Profile (the proposed framework)	Same expansion of aspect information level results; with the history of users in past queries; only the interesting stories will be nominated by using the commonness of related aspect detail among the searched sites; allow to traverse to all related aspect detail.

The key in this experiment is to see how the plan is changed from the initial plan to the plan after using the system. Since we expect that the users once found out the implicit links within site, they will find some site is more interesting than the one they already chose without the knowledge of the places. Thus, the change in plan is assumed to be an effect of the learning in given information and decisive factors in usefulness of the system. Rationally, a hypothesis is that users will adjust the plan similarly to the linked sites based on aspects provided by the system if they find the new information is more interesting and values the implicit relation of cultural heritages. Otherwise, they will not adjust the plan if the given information is not interesting to them. An example of UI for Knowledge level & Profile is illustrated in Figure 5.1.

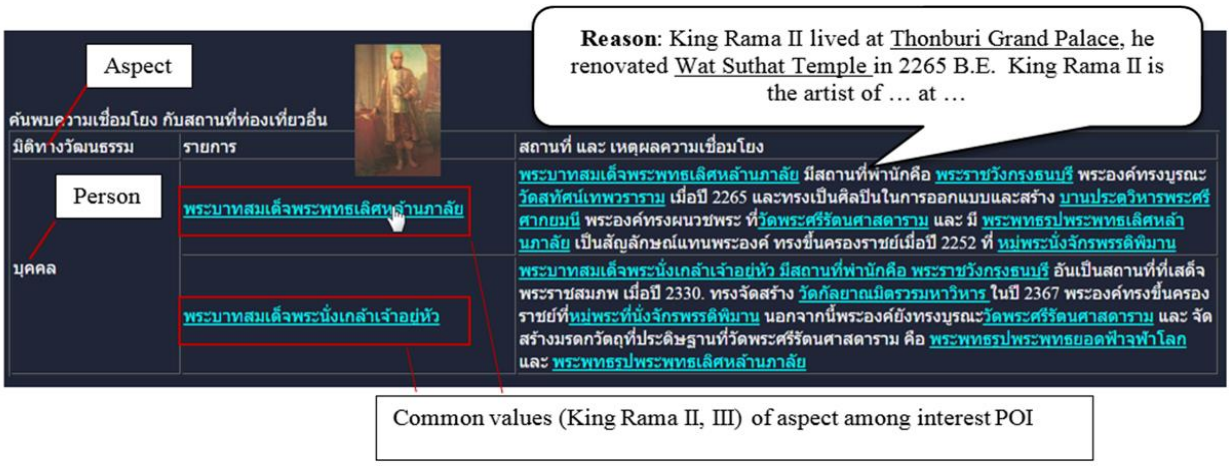

Figure 5.1. An example of UI for Knowledge level & Profile

5.3 Questionnaires

A questionnaire is designed into 2 parts for per-use and post-use of the system. The pre-use is to gather general information and background knowledge in tourism of subjects as a reference in analysis. In this pre-use, a plan of touring following the instruction mentioned in setting is also asked. The post-use is to obtain the opinion of the system in practical usage and the effect of the usage. The post-use also includes the plan of touring after using the system. The comparison of plans in pre and post-use will be conducted to see the change in planning and interpreted based on hypothesis. For easier understanding, the questions in questionnaires are summarized in Table 5.2. The questionnaires were done using google questionnaire via https://goo.gl/forms/iWQTp1Jgg3o1sQVx2.

มีสถานที่ท่องเที่ยวในแผนที่คุณไม่คุ้นเคย ปรากฏอยู่ในแผนการท่องเที่ยวของคุณในลักษณะใด

- ○ 8-10 สถานที่
- ○ 4-7 สถานที่
- ○ 1-3 สถานที่
- ○ ไม่มี เนื่องจากคุ้นเคยทุกสถานที่

เหตุผลที่คุณเปลี่ยนแปลงรายการสถานที่ท่องเที่ยว หลังจากการใช้ระบบ คืออะไร (กรณีที่แผนมีการเปลี่ยนแปลง, เลือกได้มากกว่า 1 รายการ)

- ☐ ทราบข้อมูลใหม่ ของสถานที่ใหม่ ที่น่าสนใจมากกว่า
- ☐ ทราบข้อมูลใหม่ ของสถานที่ที่เลือกไว้ก่อนหน้า แล้วลดความน่าสนใจลง
- ☐ สถานที่ใหม่ มีความเชื่อมโยงที่น่าสนใจ กับสถานที่ที่วางแผนไว้ (กรณีที่ทราบความเชื่อมโยงนี้อยู่แล้ว)
- ☐ เจอความเชื่อมโยงใหม่ ที่น่าสนใจ ที่เชื่อมโยงสถานที่ในแผนใหม่ (กรณีที่ไม่ทราบความเชื่อมโยงนี้มาก่อน)

Figure 5.2. An example of Questioners Screen

Table 5.2. Summarized questions in Questionnaires

Question Types [pre/post]	**Details [possible values]**
General Information [pre]	- Age - Gender

Background of Culture Knowledge [pre]	- How often do you go on culture-based tourism? [times/year] - How is knowledge in culture-based tourism? [1-5, lowest to highest respectively] - From your tourist plan, how many of the chosen sites are you not familiar with? [a number of sites]
Cultural Aspect [pre]	- What cultural aspects are you interesting in? [choices, can select more than one choice]
Plan Adjustment [post]	- What are the reasons in changing designated touring sites? [open text answer] - What are the reasons in maintaining designated touring sites? [open text answer]
Effectiveness of the system-generated result	- How much did the system result affect your planning? [1-5, lowest to highest respectively] - How much of the confidence in tour guiding do you have now? [1-5, lowest to highest respectively]
How is your plan help your foreigner friends in learning and viewing Thailand?	- Free text

The actual questionnaire in use is provided in Appendix B1 and a translated version to English is in Appendix B2.

5.4 Result

The results showed (see Table 5.3) that most of the subjects paid more attention in religious aspect, local wisdom aspect, object and person, respectively. 85% of them chose to state that their expertise in knowledge of cultural tourism was low or very low, and none of them clarified as good and beyond. This detail was astoundingly surprised us to learn that people usually lack expertise in culture.

Table 5.3. Information of subjects

Gender	male (28) , female (32)
Age	25-42
Expertise in knowledge of cultural tourism	very good (0%), good (0%), moderate (15%), low (78%), very low (7%)

Interest aspect of cultural tourism (allow for multiple selection)	person (30%), object (39%), belief (15%), folk-lore (23%), religion (85%), local wisdom (70%), ethnic (15%), other (8%)
How often do you go to culture-based tourism	1 time/year (68%), 2 time/year (10%), 3 time/year (5%), 4 time/year (10%), >4 time/year (7%)

From each question, a summation of answer results from pre-use is given in a chart from Figure 5.3 to 5.4.

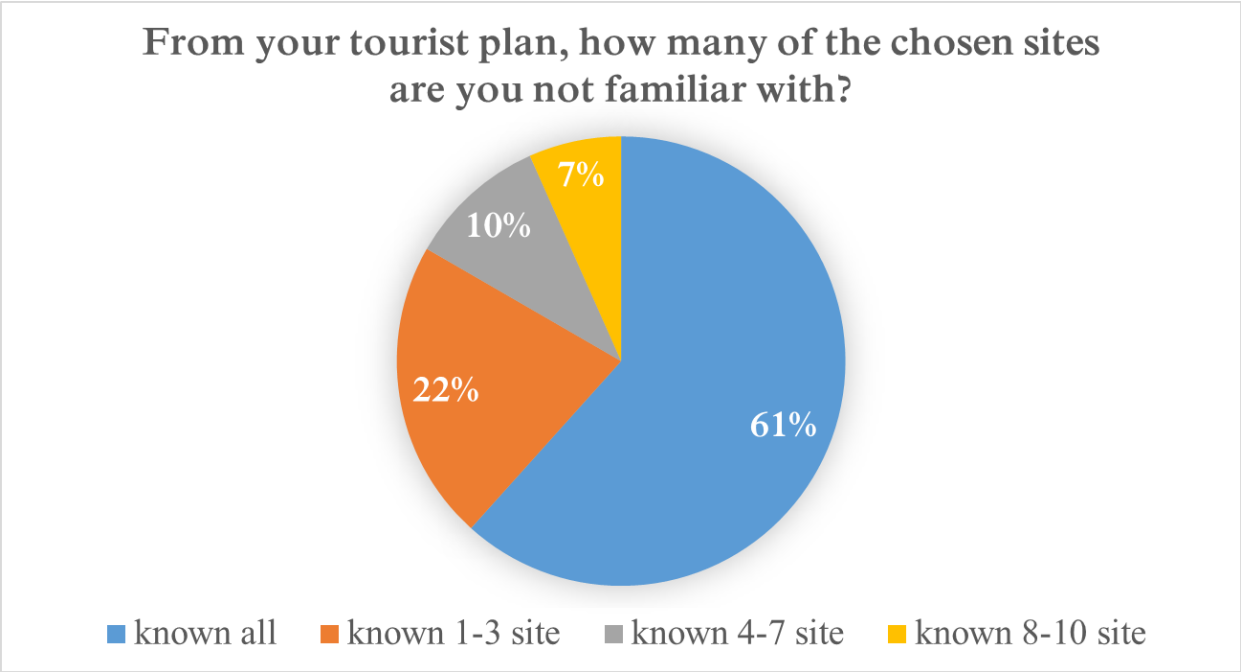

Figure 5.3. A result of question 'How many of the chosen sites that you know not familiar?'

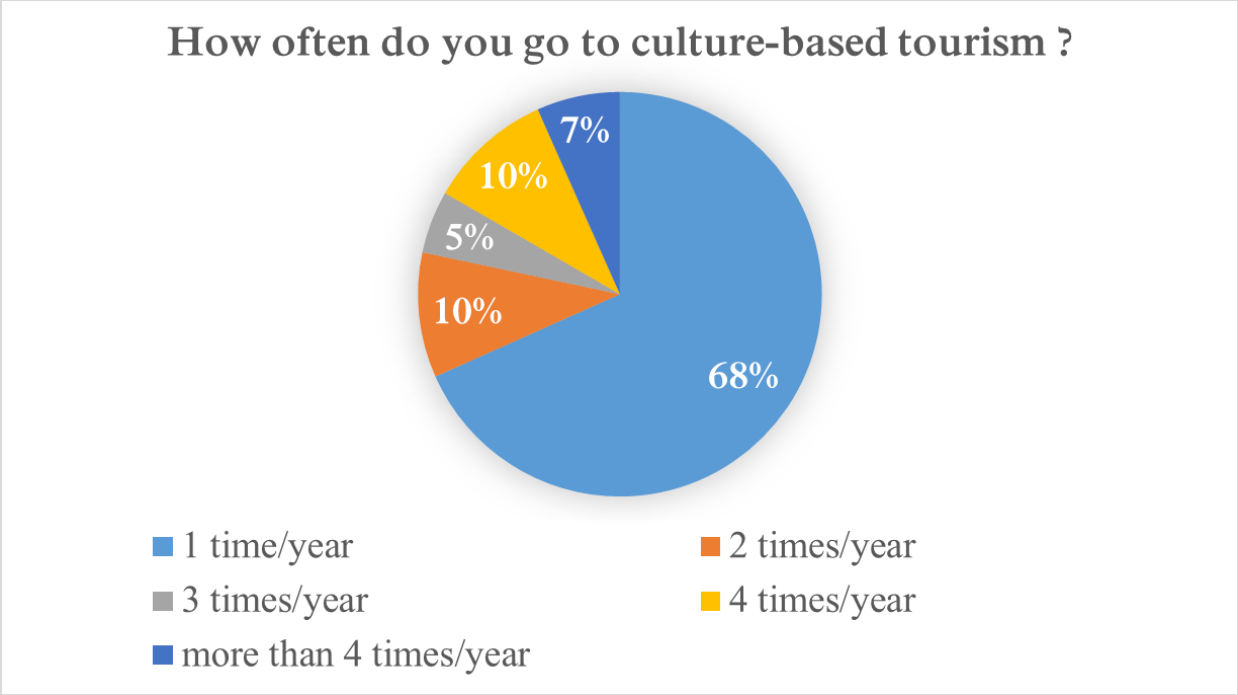

Figure 5.4. A result of question 'How often do you go to culture-based tourism?'

From overall, the initial plan of all subjects was the famous sites, and the sites were apparently selected based on popularity for physical beauty and fame without concerning on relations of heritage. From the questionnaires (see Figure 5.3), we found that subjects mostly selected the sites that they already visited and/or had known the sites. The selected sites were construction-based location such as famous temples and museums while the community-based sites were not in the selection at all. Subjects also answered that most of them are not frequent tourists in cultural based tourism from results in Figure 5.4. Moreover, from Table 5.3, only 15% of subjects were claimed to have moderate level of cultural knowledge while the rest chose to mention that their expertise in this field is low and lowest.

After using the system, each subject group shown different actions in plan adjustment as given in Figure 5.5. The first group, who were provided with only limited details of the sites, made very little changes in the initial plan. We can assume that more details of the sites alone did not convince them to change the sites into unfamiliar sites. The second group, who received the site result with relations of other sites based on aspects, changed 50% of their plan in visiting sites. For this group, most of the changes were made for 1-3 sites while a few adjusted for 4-7 sites. This can be inferred that the relations from cultural aspects apparently interest users. In details, they also stated in questionnaires that the relations lower their interest in the previously selected sited, and the relations of the sites made the adjusted sites more value in visiting by linking to the unchanged sites. The number of site adjustment based on effect of linking is given in Figure 5.6. Lastly, half of the third group, who obtained the same details of second group but pruning their results by focusing on aspects they often clicked, made adjustment to the touring plan. The reasons behind the adjustment were stated that they learned interesting unknown aspect-relation among sites, and they found new unknown sites aspect-related to another in their preferred aspect. All of

the subjects who changed the plan gave a positive reply to a questionnaire about more confidence in being a guide (shown in Figure 5.8). Other important results is showed in Figure 5.9, because the aims of the research is to open eyes of visitors in unfamiliar culture. Subject groups share the opinions about the possible viewpoints that their friends will get from the trip. This result also shown the identity of the destination culture too.

In overall, the results showed that the aspect-relation among sites was able to convince users to adjust the plan accordingly, and the touring become more interesting when minding with cultural aspects. Moreover, about 30% of subjects, regardless of group or adjusting plan, surprisingly stated in the free comment section that the aspect-relations among heritage sites enlightened them in learning a new and meaningful way of cultural touring.

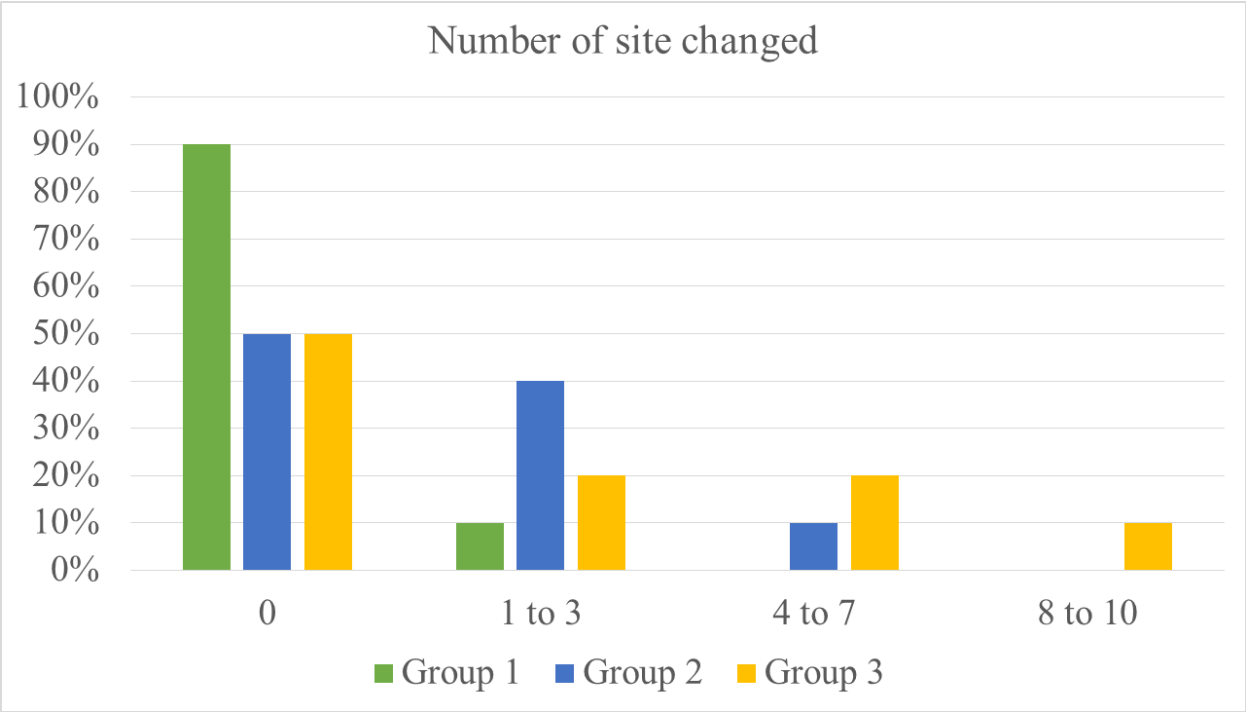

Figure 5.5. A result of site change after using a system from each group

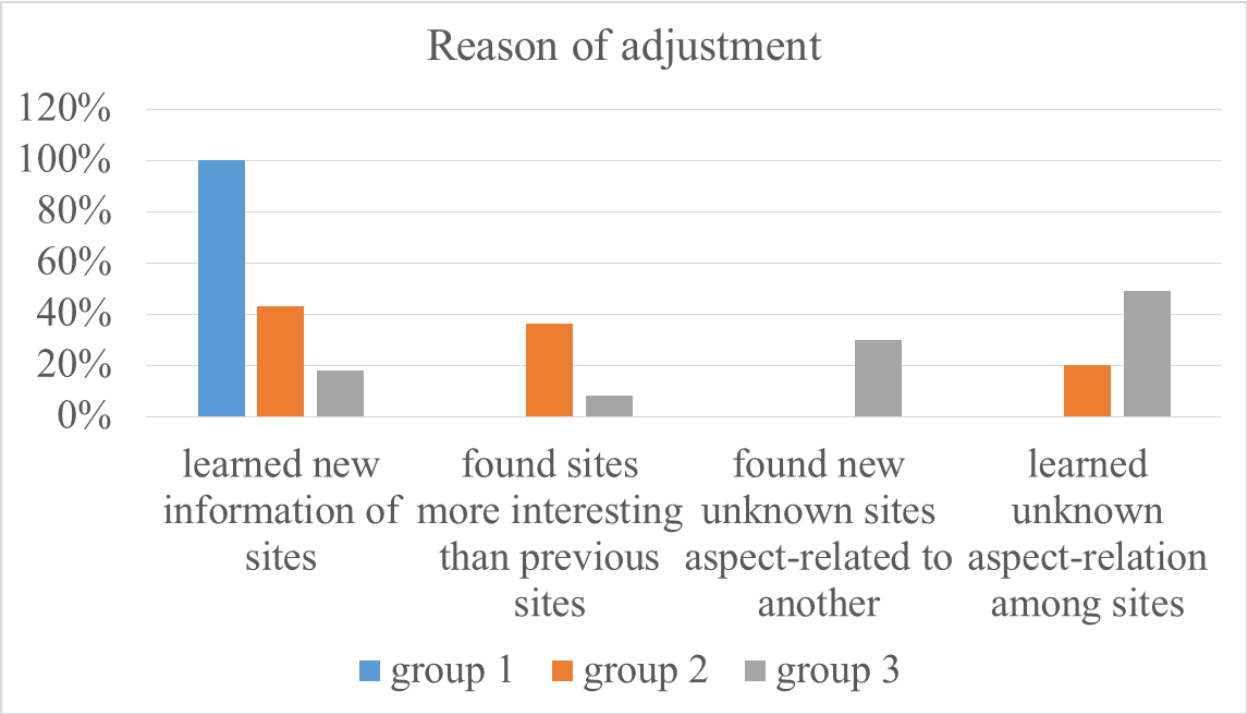

Figure 5.6. A questionnaire result of reason of adjustment in site plan after using a system (several answers per person)

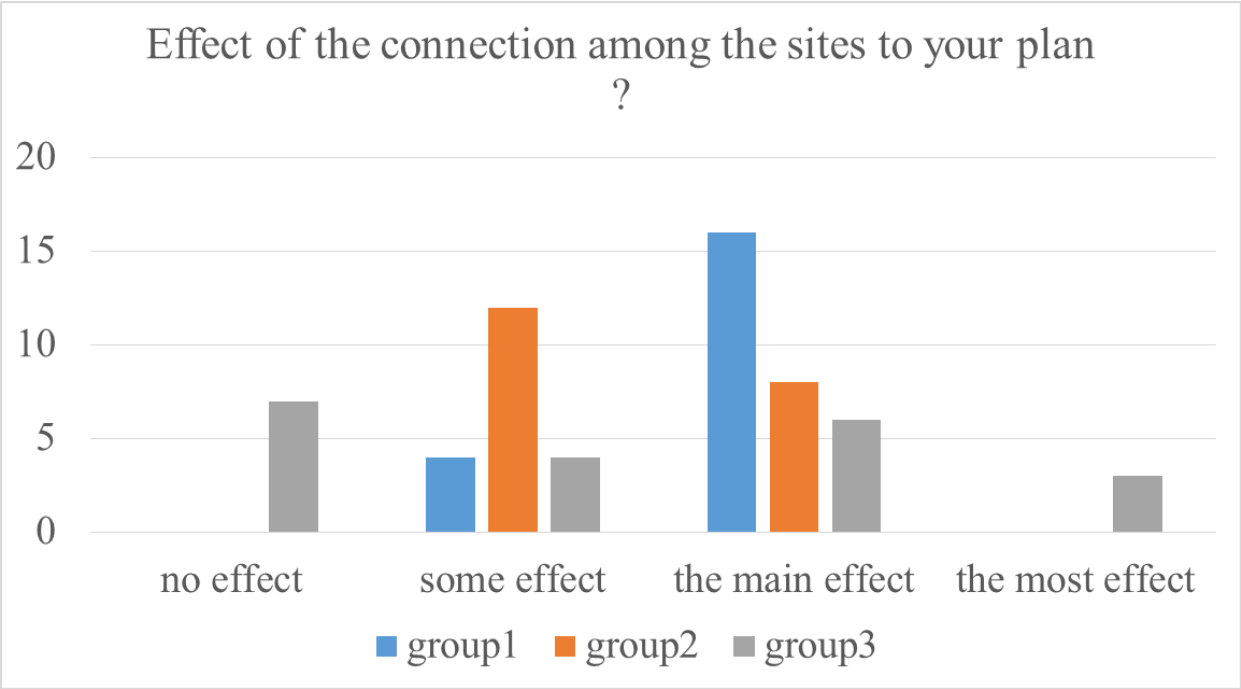

Figure 5.7. A result about effect of a system (counted by site change)

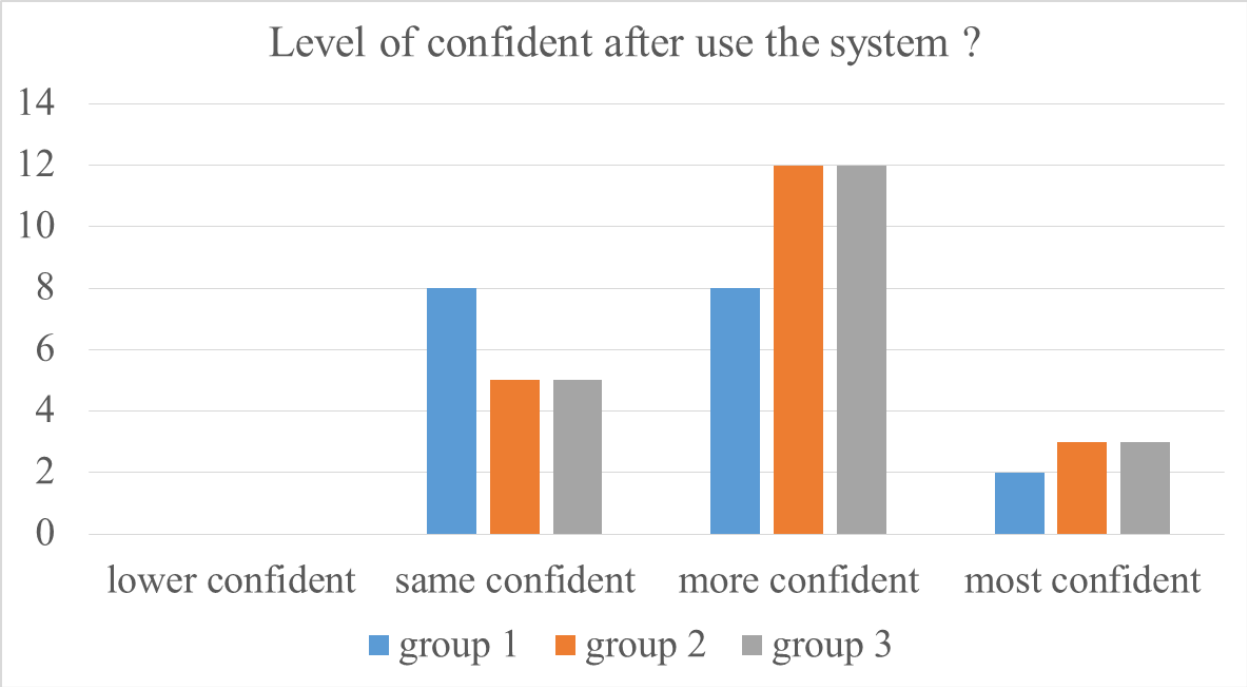

Figure 5.8. A questionnaire result about user confidence after learning new implicit relation from a system

Figure 5.9. A questionnaire result of the question 'How is your plan help your foreigner friends in learning and viewing Thailand?'

However, we also analyzed the reasons of unchanging plan from the subjects. We classified into three types of reason. The first reason was that the subjects decided the initial plan based on the variety of locations. They mainly chose the variety based on the assumption that they were to be a guide for their foreigner friends and they were not sure what aspects their friend will favor. Hence, the aspect-relations were not taken into considering their planning. The second reason was those who only chose the sites based on their personal experience. They mentioned that they do not have confidence in guiding friends to where they never visited despite how interesting the sites are. Thus, their selection would not be changed with only information given but direct experience. The last reason was that the subjects considered distance, time consuming in travelling and cost. Even though the prior statement in assumption that these factors are excluded, they naturally considered these factors in the planning, and this showed us how important these factors can greatly affect the decision in tourism.

Example plan made by the subject from group3.

Trip plan details [before used the system]

- Day1:
    1. Wat Phra Kaew (Temple of Emerald Buddha)
    2. Wat Arun
    3. Wat Pho
    4. Wat Bovorn Nivet Vihara
- Day2:
    1. Bang Sai Royal Folk Arts and Crafts Centre
    2. Wang Chang Lae Phanait (Elephant village)
    3. Chitralada Royal Villa (Palace)
    4. Jim Thomson House

Trip plan details [after used the system]

- Day1:
    1. Wat Phra Kaew Kamphangphet
    2. Wat Phra Kaew Chiangrai
    3. Wat Phra Kaew Chaingmai
    4. Wat Arun
    5. Wat Phra Kaew (Temple of Emerald Buddha)
- Day2:
    1. Ang Khang Station (Royal Project)
    2. Wat Bovorn Nivet Vihara
    3. Chitralada Royal Villa (Palace)
    4. Wat Phra Ram IX
    5. Siriraj Hospital

By this example, subject plan the trip based on the famous and familiar places. However, after used the system, he found new interesting sites that effect to his plan. In the first day, the plan focusing on the traverse route of Emerald Buddha. In the second day, the plan focusing on the place that related to the King Rama IX.

5.5 Summary

Subjects revealed that all of them get more confidence to be a tour guide according to the plan. The results enlightened them by convincing stories unknown to them. Despite the lack of background knowledge, system opened visitor's eye to new cultural world. New (unfamiliar) cultural sites are added to their plan.

Chapter 6
Conclusion and Further Works

6.1 Introduction

This chapter presents the conclusion and future works of the research. Section 6.2 will review the research findings as the evidence for answering the research questions discussed in chapter 1. The last section concludes this dissertation with the discussion of further works especially the direction for the plan of magnitude design and development in the next version.

6.2 Conclusion

We introduced a mixed initiative search using ontology as knowledge base to extend viewpoint in culture-base tourism. This work focuses on transferring implicit relation in cultural heritages in aspects to form a story-based of tourist sites. The linked story based on cultural aspects is expected to urge users to learn the hidden importance of the heritages in which do not only contain value of physical beauty, but also as invaluable cultural representatives. The Cultural Tourism Ontology was carefully crafted to represent all aspects in cultural value, and instances of the concepts were manually mapped to assure the highest quality in the usage. The mixed initiative search applying the ontology was implemented to provide the aspects of cultural sites matching to users' query while the query was further processed to expand more results culturally related to the initial result regarding aspects provided in the ontology. From experiments, subjects revealed that most of them learned to enjoy cultural tourism more from using the system since the results enlightened them in cultural aspects unknown to them. Moreover, they found value in the revealed relations of heritages, and this opened their new viewpoint and become more interesting in culture-based tourism. The results also showed that the relation within heritages providing with the power of the ontology can help users to learn new information rarely found elsewhere.

From the result, a limitation of the proposed system is that the current aspects may be insufficient to represent all existing dimensions of culture-based tourism. Since the current work focused on Thai based culture, some aspects are not yet included, such as some countries may develop their culture around sport (soccer in The Great Britain). More cultural aspects should be added to fill in the lack. There was also a request to allow users to freely custom aspects in searching since some users may initially realize their interest aspects and want a result according to those without other uninteresting aspects. Furthermore, the current work was designed as a model to inspire culture-based tourism; hence, we did not take actual time frame in travelling and distance into account. In the public version, we plan to include and consider these factors in the searching results for practical usage.

6.3 Contribution

From the working in this dissertation, I can conclude that this work contributes two major findings. The first one is that, in cultural tourism, visiting sites are related to one another in some aspects, and they can be linked together to form an interesting connected touring. The ontology can be designed to support this implicit and complex relations of the abstract concepts into machine-readable and to become interoperable in solid structure rationally. The second one is the finding that the use of cultural aspects from predefined knowledge in extraction of a cultural dependent story can trigger to stimulate human's interest by let one learn the unknown in relational story.

6.4 Future works

To better support of user story, system should provide the pool storage for user to create (telling) their own story and share with other user. System should provide mechanism for create a collection of stories/searching/rating score. The system should allow users to freely adjust their preferable aspects to prevent a cold start of new users and more precision result. Another challenge for tourism research is how to capture the unique atmosphere of the place. For example, when we visit Death Railway in the city of Kanchanaburi, the atmosphere could take we feel the realness of that time. In next ten year that feeling may not exist anymore. Transfer of unique atmosphere of the site via the computer system is the big challenge.

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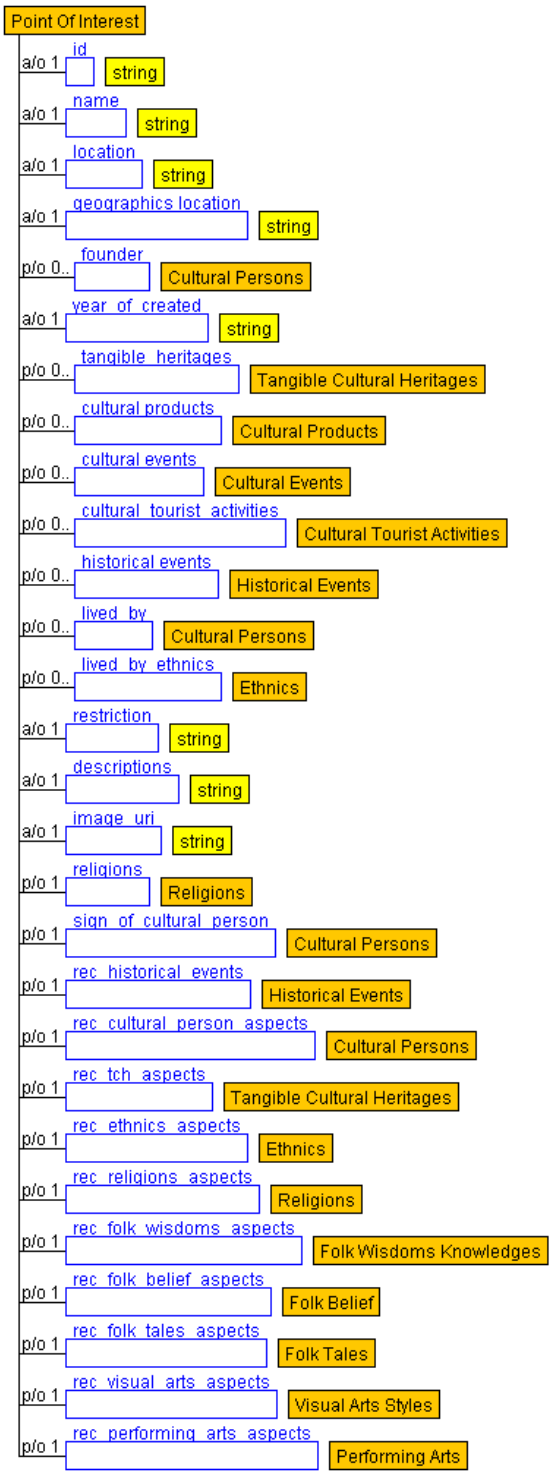
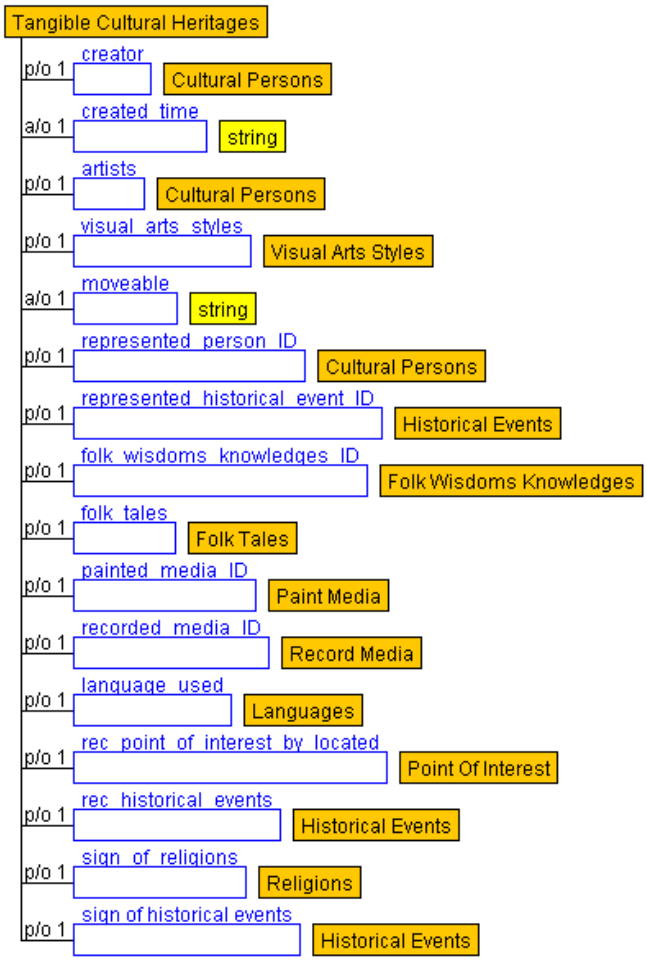
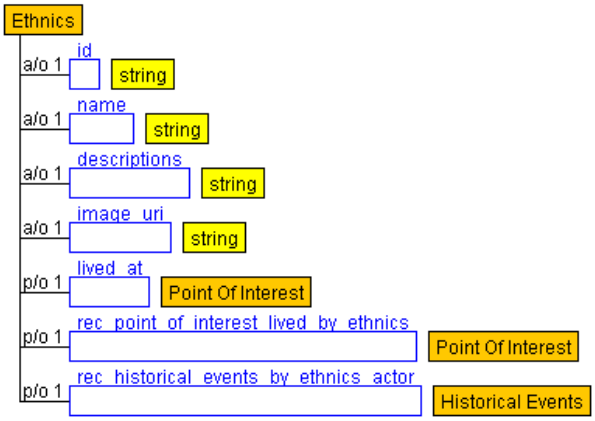
Appendix A



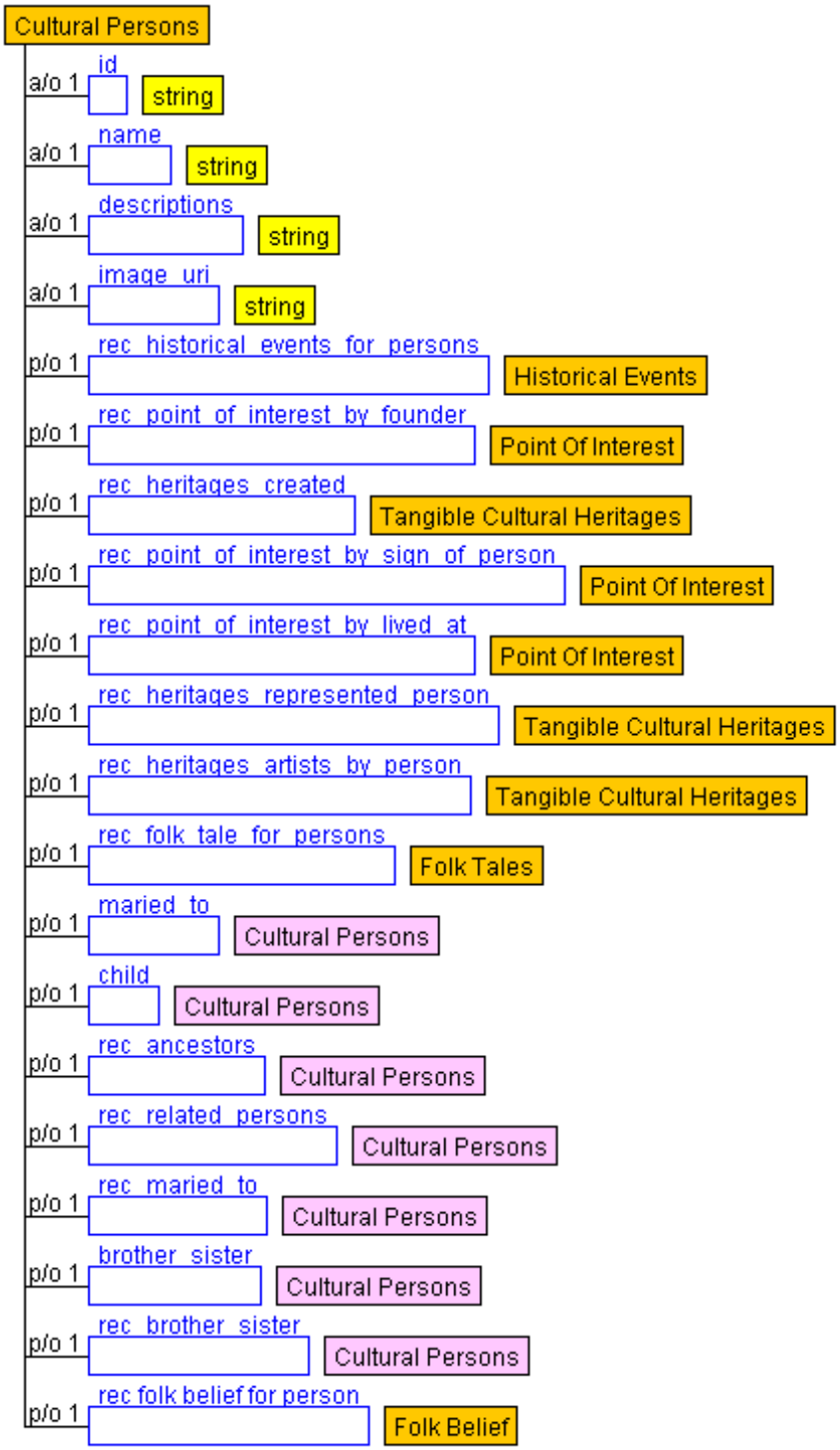
Point of Interest concept.



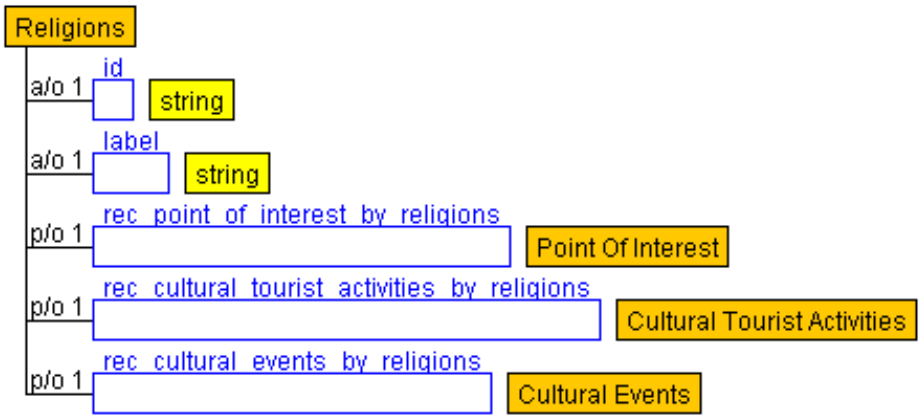
Tangible Cultural Heritage concept.



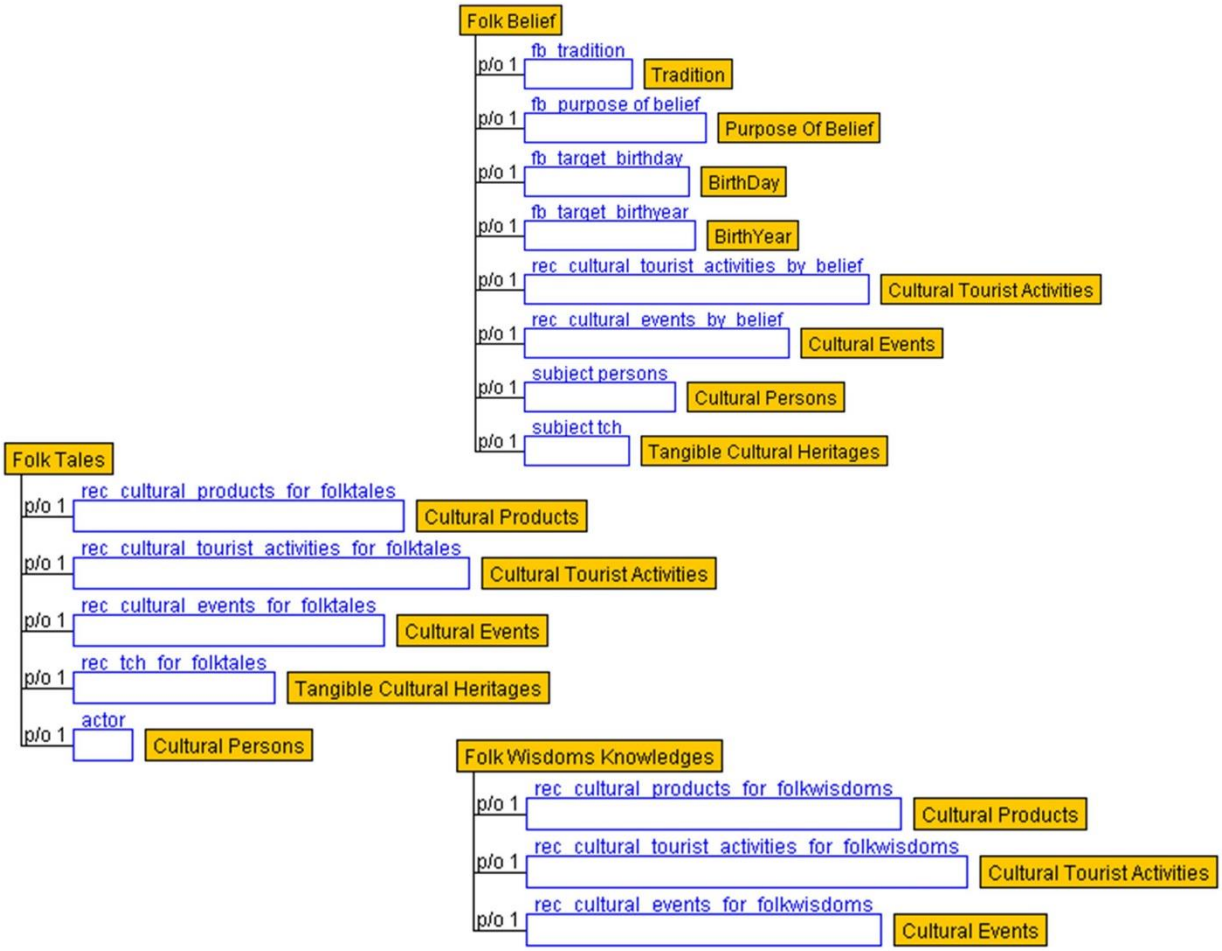
Ethnics concept



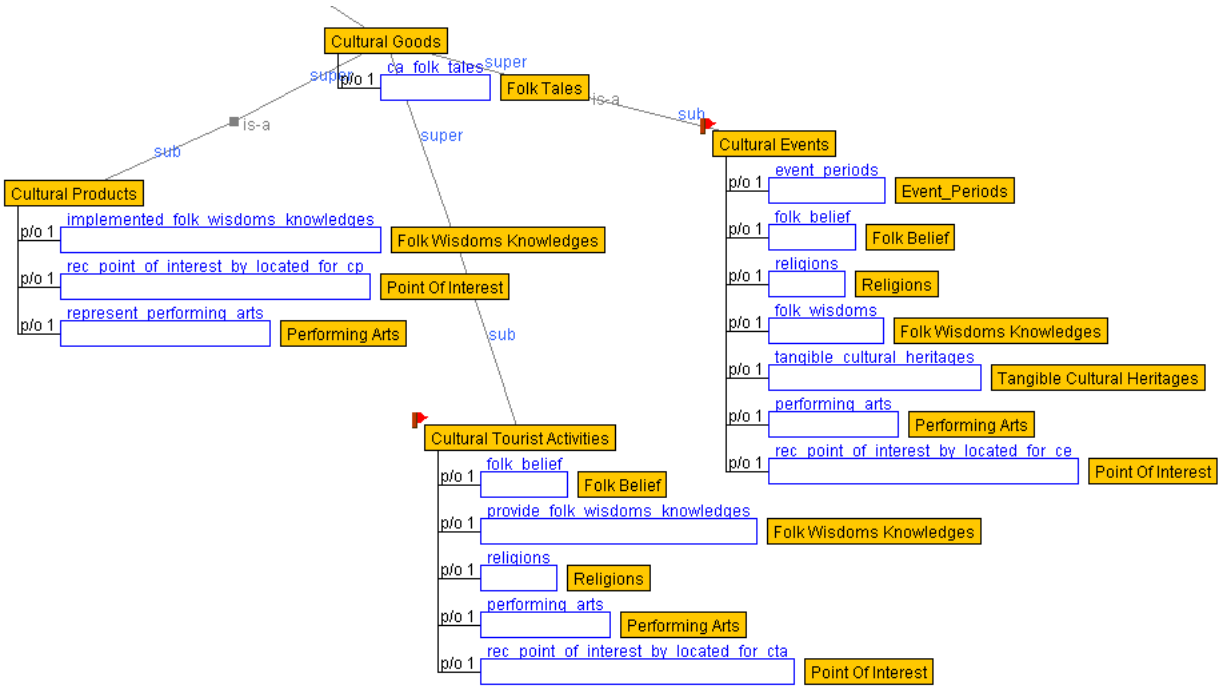
Cultural Person concept



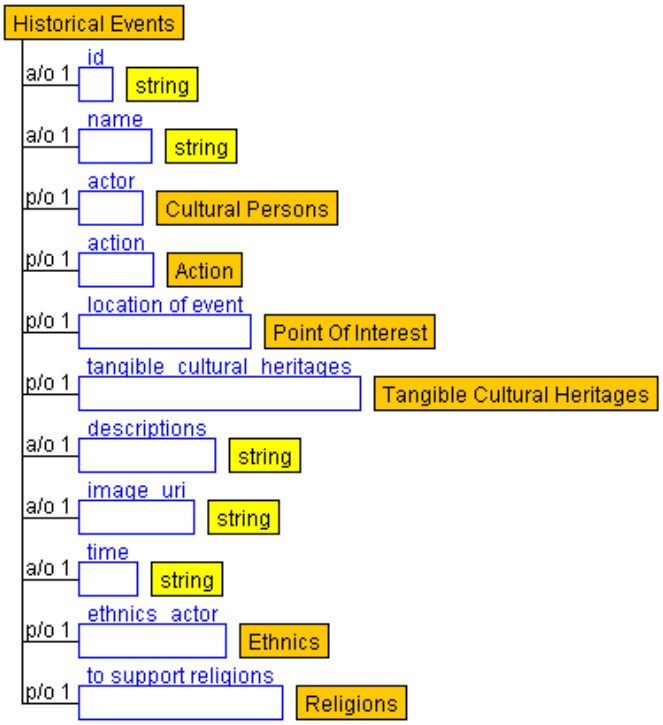
Religion concept



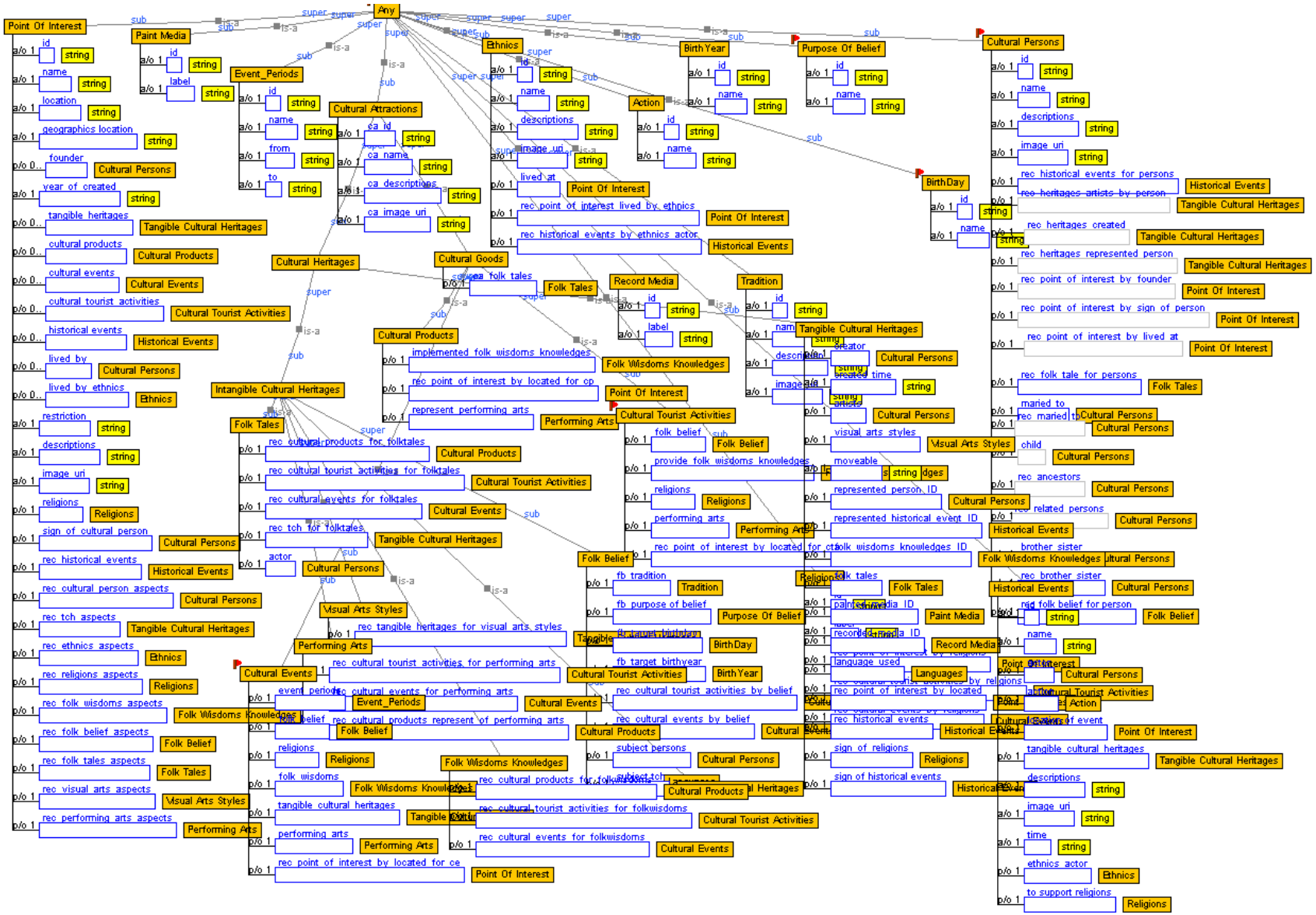
Intangible sub concepts



Cultural good & sub concept



Historical event concept



Cultural Tourism Ontology concepts

Appendix B1

- แบบสอบถามหลังการวางแผนท่องเที่ยว
- ชื่อ **…**
- อายุ **…**
- เพศ **…**
- อีเมล์ **…**

- ระบุระดับความรู้เกี่ยวกับข้อมูลของแหล่งท่องเที่ยวทางด้านวัฒนธรรมของประเทศไทยของท่าน (ก่อนใช้ระบบ)

  - ดีมาก
  - ปานกลาง
  - น้อย
  - น้อยที่สุด

- **[**แผนเริ่มต้น ก่อนใช้ระบบ] รายการสถานที่ท่องเที่ยว วันที่ **2 (**ระบุ สถานที่ ระหว่าง **2-5** สถานที่ ต่อวัน)
  - **…**
- **[**แผนหลังจากใช้ระบบ] รายการสถานที่ท่องเที่ยว วันที่ **1 (**ระบุ สถานที่ ระหว่าง **2-5** สถานที่ ต่อวัน)
  - **…**
- ทริปนี้ เพื่อนต่างชาติของคุณจะได้รับมุมมองต่าง ๆ เกี่ยวกับประเทศไทยอย่างไรบ้าง (เช่น ได้รับมุมมองเกี่ยวกับพระราชกรณียกิจของพระมหากษัตริย์ รัชกาลที่ **9 ,** เข้าใจเรื่องราวเกี่ยวกับความเชื่อการบูชาพระแม่คงคา**,** รู้ประวัติของพระแก้วมรกต...)
  - **…**
- ข้อมูลด้านใดที่เกี่ยวกับวัฒนธรรมไทยที่มีผลต่อการตัดสินใจวางแผนของคุณ (เลือกได้มากกว่า **1** รายการ)
  - บุคคลสำคัญ
  - มรดกวัตถุ
  - ความเชื่อ

- เรื่องเล่าพื้นบ้าน
- ศาสนา
- สถาปัตยกรรม/ศิลปกรรม
- ภูมิปัญญาท้องถิ่น
- ชาติพันธุ์
- อื่น ๆ

➢ มีความเปลี่ยนแปลงในส่วนของรายการสถานที่ท่องเที่ยว จาก แผนเริ่มต้นก่อนใช้ระบบ และ แผนหลังจากใช้ระบบอย่างไร

- **8-10** สถานที่
- **4-7** สถานที่
- **1-3** สถานที่
- ไม่เปลี่ยนแปลง

➢ มีสถานที่ท่องเที่ยวในแผนที่คุณไม่คุ้นเคย ปรากฏอยู่ในแผนการท่องเที่ยวของคุณในลักษณะใด

- **8-10** สถานที่
- **4-7** สถานที่
- **1-3** สถานที่
- ไม่มี เนื่องจากคุ้นเคยทุกสถานที่

➢ เหตุผลที่คุณเปลี่ยนแปลงรายการสถานที่ท่องเที่ยว หลังจากการใช้ระบบ คืออะไร (กรณีที่แผนมีการเปลี่ยนแปลง, เลือกได้มากกว่า **1** รายการ)

- ทราบข้อมูลใหม่ ของสถานที่ใหม่ ที่น่าสนใจมากกว่า
- ทราบข้อมูลใหม่ ของสถานที่ที่เลือกไว้ก่อนหน้า แล้วลดความน่าสนใจลง
- สถานที่ใหม่ มีความเชื่อมโยงที่น่าสนใจ กับสถานที่ที่วางแผนไว้ (กรณีที่ทราบความเชื่อมโยงนี้อยู่แล้ว)
- เจอความเชื่อมโยงใหม่ ที่น่าสนใจ ที่เชื่อมโยงสถานที่ในแผนใหม่ (กรณีที่ไม่ทราบความเชื่อมโยงนี้มาก่อน)

➢ รายละเอียดความเชื่อมโยงของสถานที่ที่พบ ในระหว่างการวางแผน ส่งผลต่อความน่าสนใจเลือกสถานที่เข้าเป็นส่วนหนึ่งของแผนการท่องเที่ยวอย่างไร

- ไม่มีผลเลย
- น้อย

- ○ มาก
- ○ มากที่สุด

➢ จากแผนการท่องเที่ยว และข้อมูลที่คุณได้รับในระหว่างการวางแผนการท่องเที่ยว คุณมีความมั่นใจในการเดินทางท่องเที่ยวเพื่อแนะนำ/ศึกษา วัฒนธรรม ตามแผนการท่องเที่ยวเพียงใด

- ○ ลดลง
- ○ เท่าเดิมกับก่อนวางแผน
- ○ มากขึ้นกว่าก่อนวางแผน
- ○ มีความมั่นใจเต็มที่ที่จะนำเที่ยว

Appendix B2

- Questionnaires
- Name...
- Age...
- Gender...
- Email...

- Expertise in knowledge of cultural tourist

  - Very good
  - Good
  - Moderate
  - Low
  - Very Low

- [Before use system] List of the visit sites for 2 days (2-5 sites/day)
  - …
- [After use system] List of the visit sites for 2 days (2-5 sites/day)
  - …
- How is your plan help your foreigner friends in learning and viewing Thailand? (allow for multiple answer)
  - …
- Interest aspect of cultural tourism (allow for multiple selection)
  - Person
  - Object
  - Belief
  - Folk lore
  - Religious
  - Architecture
  - Local wisdom

- Ethnic
- Other

- Number of sites changed?
  - 8-10 sites
  - 4-7 sites
  - 1-3 sites
  - No changed
- How many sites in the plan do you know well?
  - 8-10 sites
  - 4-7 sites
  - 1-3 sites
  - Known all
- Reason of adjustment, (allow to select multiple reasons)
  - Learned new information of sites
  - Found sites more interesting than previous sites
  - Found new unknown sites aspect-related to another
  - Learned unknown aspect-relation among sites
- Effect of the connection among the sites to your plan?
  - No effect
  - Some effect
  - The main effect
  - The most effect
- Level of confident after use the system?
  - Lower confident
  - Same confident
  - More confident
  - Most confident