

# SMART TRAVEL PLANNING FOR CHIANG MAI'S ECOTOURISM

Wapee Manopinives\*, Orawit Thinnukool and Vimolboon Cherapanukorn  
College of Arts, Media and Technology, Chiang Mai University, THAILAND

## Introduction

While Thailand benefits from being one prime tourism destinations on earth, Chiang Mai has traditionally been top five most popular cities for tourists in the country. Welcoming over 10 million visitors in 2017, Northern Thailand in general and Chiang Mai in particular, is presented with significant challenges regarding the maintenance of its innate natural beauty, abundant resources and enriching cultural heritage. Chiang Mai's most notable natural resources are its lush flora, timber covered mountains and its many lakes, walking and hiking trails. Because of its breathtaking beauty, natural resources and the seemingly endless number of places to discover, the city has been recognized as a top destination for ecotourism. With all of this in mind, it would be a good idea for tourists to have access to a platform which provides up to date information about the variety of destinations available to visit in Chiang Mai along with predetermined plans about ecotourism excursions in Chiang Mai. It has been determined from a recent survey, that at present, there are no applications yet under development which offers these conveniences.

The magnitude of information communication technologies in tourist understanding and experience has been confirmed by past studied (Neuhofer et al., 2014) as well as in transforming the meaning of travel (Wang et al., 2012). Information communication technologies, particularly mobile technologies, increasingly influence the formation, facilitation and co-creation of tourist experience (Neuhofer et al., 2014). Consumers use IT extensively to evaluate alternative travel opportunities and to compare and contrast offerings (Law et al., 2009). Using meta search engines, potential travelers can identify and evaluate products according to their preferences, filters, and requirements (Buhais & O'Connor, 2005). On-site information search through the website also enhances travel experience and influences how tourists view a destination (Wang et al., 2012).

In this study, we develop a web-based application providing updated destinations and suggested plan about ecotourism in Chiang Mai. As a pilot study, the most popular 10 ecotourism destinations in the city were collected from the secondary data observation through website. The classical method of travelling salesman problem (TSP) is applied to create the suggested travel plans for ecotourism routes starting from the city center. We consider the different time constraints between 3 and 48 hours for tourists to offer each trip plan and travel itinerary.

## Literature review

### Traveling salesman problem

Traveling Salesman Problem (TSP) is one of the most classical and famous problem in the field of operations research and computer science. It is a mathematical optimization problem which better solutions often means a solution that is cheaper. The problem can simply be stated as: if a traveling salesman wishes to visit exactly once each of a list of  $n$  cities (where the cost of traveling from city  $i$  to city  $j$  is  $c_{ij}$ ) and then return to the home city, what is the least costly route the traveling salesman can take? Arithmetically, the traveling salesman problem can be depicted in graph form, showing places of interest as the points and the edges (or arcs) represent direct routes between the points of interest. The importance of each edge is the distance between the points. The goal is to find the path with the least amount of time constraints and obstacles.

An extensive examination of every possible route would be sure to reveal the fastest course possible. Unfortunately, it is mathematically recalcitrant to manage a large number of locations at the same time. For greater problems, techniques are needed in order to logically research the problems and find near-optimal solutions. A comprehensive study of this and related problems can be found in Hoffman and Wolfe. (1985), Applegate et al. (2006), and Cook (2011). Recently, TSP has been applied to offer a trip plan of tourist destinations problem. Those aimed to generate itineraries that maximize the

total value of the attractions visited and minimize the total travel cost involved. (Fathi et al., 2018; da Silva et al., 2018; Hashim and Ismail, 2017; Barrera et al., 2016)

### **Ecotourism**

Ecotourism is a form of tourist travel which involves visiting relatively natural and undisturbed areas. It is meant to be a way of traveling which has low impact on the natural environment conserving the environment and improving the well-being of the local people. Since the focus of ecotourism is primarily on socially responsible travel and environmental sustainability, people and organizations who develop and execute ecotourism programs and similar projects should adhere to the following sustaining principles (TIES, 2015):

- Minimize human impact on the natural environment socially and behaviorally
- Foster awareness of the environment and respect for culture
- Encourage mutually enjoyable experiences for both hosts and visitors
- Finance the costs of conservation.
- Create income for the local community and private businesses.
- Offer experiences which are memorable to visitors that help raise sensitivity to a host of environmental problems.
- Operate environmentally friendly businesses which have a low-impact on the environment.

Be mindful of the beliefs and rights and of the Indigenous and help to empower the community.

### **Method study**

This section presents our ways of doing work to develop a smart travel planning for Chiang Mai's Ecotourism as follows:

#### 1) An initial survey of ecotourism attractions in Chiang Mai

Because of its breath-taking beauty, natural resources and the seemingly endless number of places to discover, the city has been recognized as a top destination for ecotourism. Anyhow, as a pilot study, the most popular ten ecotourism destinations were collected from the secondary data observation or the internet search. The top ten attractions from several websites can be shown in figure 1.



Figure 1: Selected ten ecotourism attractions in Chiang Mai

## 2) TSP for selected ten ecotourism attractions

We create the TSP matrix for the most popular ten ecotourism destinations by using the Google Maps Distance Matrix API. This can also help calculate distances between attractions as well as create the distance matrix from the results. The code shown below creates the data for the problem: the attractions and the distance matrix, whose entry in row  $i$  and column  $j$  is the distance from city  $i$  to city  $j$  in kilometres and travel time by car in hours.

```
# Attraction
Attraction_names = ["Chiang Mai Zoo", "Doi Pui National Park", "Huay Tueng Tao Lake", "Ban Khan Chang Khian
Orchardom", "Maesa Waterfall", "Maesa Elephant Camp", "Mon Chasen", "Queen Sirikit Botanic Garden", "Tad Mok
Waterfall", "Royal Park Rajapruek"]

# Distance matrix
distance_matrix =

[ 0, 22144, 11.3022, 24.8754, 22.1732, 25.5704, 36.5753, 28.8743, 28.541, 12.7024 ] # Chiang Mai Zoo
[ 22144, 0, 12.4161, 2.8710, 43.273, 4778, 5997, 58.487, 5693, 2263 ] # Doi Pui National Park
[ 11.3022, 13.481, 0, 11.758, 16.622, 3026, 31.144, 23.434, 23.232, 19.228 ] # Huay Tueng Tao Lake
[ 24.8754, 2.8710, 11.758, 0, 28.378, 31.861, 42.8108, 33.684, 34.887, 35.782 ] # Ban Khan Chang Khian
[ 22.1732, 43.273, 16.622, 28.378, 0, 4.78, 15.828, 6.611, 11.619, 38.440 ] # Maesa Waterfall
[ 25.5704, 4778, 2925, 31.861, 4.78, 0, 1179, 1.83, 1522, 33.843 ] # Maesa Elephant Camp
[ 36.5753, 5997, 31.144, 42.8108, 15.828, 1118, 0, 1122, 12.428, 46.863 ] # Mon Chasen
[ 28.8743, 58.487, 23.434, 33.684, 6.611, 1.83, 1122, 0, 16.824, 28.846 ] # Queen Sirikit Garden
[ 28.541, 5083, 23.232, 34.887, 11.619, 1522, 12.428, 16.824, 0, 38.870 ] # Tad Mok Waterfall
[ 12712.7, 2083, 19.228, 35.782, 30.440, 33.843, 44.863, 36.648, 36.850, 0 ] # Royal Park Rajapruek
```

Figure 2: Distance matrix of ecotourism attractions in Chiang Mai

## 3) Development of web-based application

Designing the web application involves the graphic user interface, the content on the website, and showing the way of development. Our work aimed to develop a web application that presents a smart travel planning for Chiang Mai's Ecotourism. In this step, analysis of the ecotourism attractions and categorization are considered. Databases were created to record the following information: 1. Ecotourism Destinations 2. Distance 3. Activity Information 4. Time Tour 5. VDO 6. Picture

Secondly, the designed database also contained the file: (i) Design database structure (entity relational) (ii) Normalization (iii) Development database

Third, the web structure design contained the directory of the website:

- (i) Title page (the home page showing a picture of Chiang Mai Ecotourism)
- (ii) Ecotourism attractions (the menu showing information of each top ecotourism attractions)
- (iii) Recommended routes (the menu suggesting a smart travel planning under time constraints)
- (iv) Searching (the text box which accept keywords to search for ecotourism attractions)
- (v) About the project (information on this project)

Fourth, the Graphic User Interface (GUI) was designed, which provides access by and interaction between users and the system and the exchange of information. Graphical multimedia was also used displaying Chiang Mai Ecotourism photography.

## 4) Development and Implementation

The development of the web application for smart travel planning also used SQL and an available program for developing the website using a responsive web site pattern. A requirement of the web application for smart travel planning was the need to create a trip plan and travel itinerary. We installed this requirement through social media plug-in code for support interaction, collaboration, and knowledge sharing. Figures 3 presents the example showing each panel displaying top ecotourism attractions and information.

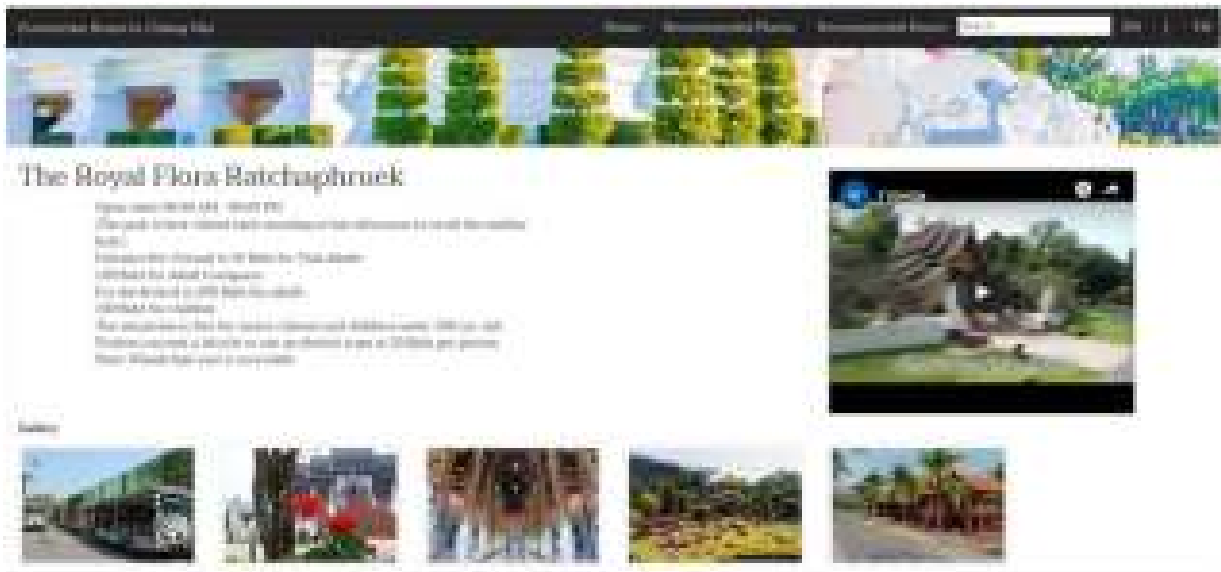


Figure 3: Information display of Royal Flora Ratchaphruek

The study purposes the plan based on the length of traveling duration between 3 hours and 48 hours for tourists to manage their traveling time as shown in figure 4. An example of created trip plan and travel itinerary by TSP algorithm for ecotourism route in Chiang Mai starting from the center shown in Figure 5 and 6.



Figure 4: Options for traveling duration



Figure 5: Offered programs for 6 hours traveling duration

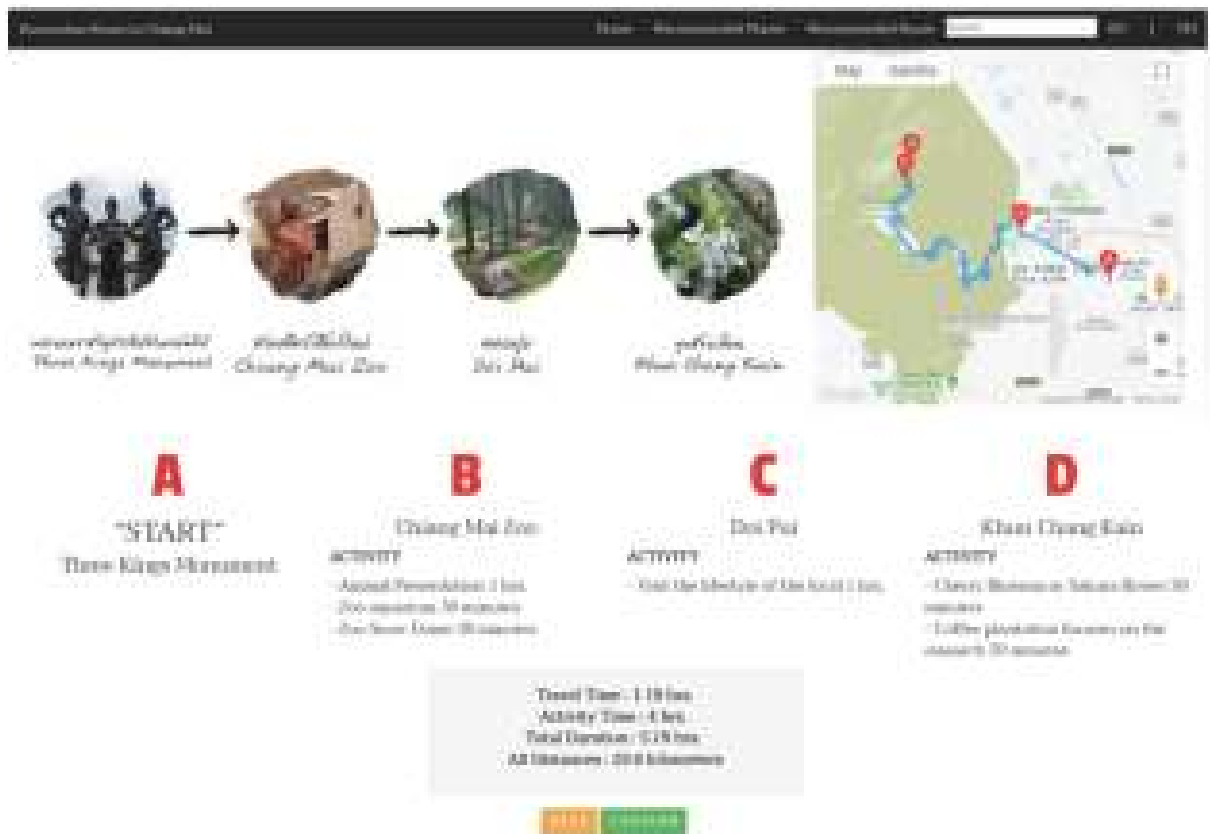


Figure 6: Selected trip plan and travel itinerary



Figure 7: The display of home menu on smartphone

The responsive retrofitting web pattern provided an appropriate display for many devices such as a desktop computer, a tablet computer, and a smart phone. Our development can handle the resolution problem and display in an appropriate size on the screen. Figure 7 shows the appropriate size for display on a smartphone which is how the majority of people access web applications. After the development and implementation testing, the web application was uploaded to the internet, which could then be accessed using different devices. The outcome of the development contributed to a smart travel planning for Chiang Mai's Ecotourism.

### **Discussion and conclusion**

With economic development, people have more and more free time and become more leisure-oriented. However, because of the time and physical constraints, most of the people are prone to taking short vacations. Well planning in advance is the foremost task that must be done in order to have a pleasant trip. A good travel plan not only allows a visitor gain the maximum enjoyment during the trip, but also satisfies his/her needs within the time and budget constraints. This study employs the advantages of traveling salesman problem to the tourism context. The outcomes of this research are presented and available for the target tourists as the web technology platform which could increase tourists' satisfaction level when they are looking for a travel itinerary planning for ecotourism destinations in Chiang Mai. We use modern computer-based technology, which is not new but is an appropriate development. Our development produced a web application which has been uploaded to the domain name at [www.ecotourismchiangmai.com](http://www.ecotourismchiangmai.com). The design and development accommodate user needs looking for a smart travel plan.

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