

A Cloud-Based Management Information System for Medical and Wellness Tourism

Putsadee Pornphol, Chantinee Naveevong, and Suphamit Chittayasothorn

Abstract—Medical tourism in Thailand is recognized as one of the top three in the world. There are many medical tourists coming to Thailand for having medical treatments every year, getting surgery, beauty treatment, and cosmetic surgery. The main factors leading Thailand to become a major destination in medical tourism are the expertise of the doctors, advanced medical tools and technologies, and, especially, reasonable prices. Moreover, Thailand is a great place for rehabilitation after the medical tourists have had medical services, due to Thailand having many beautiful tourist attractions with convenient accommodations at affordable prices, various choices of cuisines, as well as the thousands of Thai people ready to welcome tourists to the Kingdom of Thailand.

This paper presents a concept about the requirement of the information systems support for potential growth of medical tourism in Thailand, while market competition is increasing. Therefore an information system that works on cloud computing for cosmetic clinic management was developed by the cooperation of researchers, doctors and network service providers who are famous and professional in terms of service to both the private and the public sectors.

Index Terms—Medical tourism, medical tourist, information systems, cloud computing, CMS-SMSs.

I. INTRODUCTION

In 2015, the Tourism Authority of Thailand expects that Thailand will be a world destination for anti-aging & aestheticism alongside tourist attractions, as Thailand is famous in terms of specific medicine with advanced technologies and medical instruments, as well as reasonable prices of medical fees. Medical tourism can also spread income into other businesses, such as hotels, transportation agencies, restaurants, tourist agencies, because the tourists who come for medical tourism usually have a high purchasing power [1].

Medical tourism in Thailand is accepted as one of the top three in the world. In 2014, there were nearly three million medical tourists. The medical tourists visited Thailand for popular medical treatment or plastic surgery, including breast implants, breast lift, breast reduction, facelift, buttocks implants, liposuction, tummy tuck, nose surgery (Rhinoplasty), lowering of eyelids, and sex change surgery (MTF & FTM).

Manuscript received October 13, 2015; revised December 14, 2015.

Putsadee Pornphol is with the Department of Computer Science, Faculty of Science and Technology, Phuket Rajabhat University, Phuket, Thailand (e-mail: proud.it.pkru@hotmail.com).

Chantinee Naveevong is with the Smart Solution and Service Co.,Ltd., Samut Prakan,Thailand (e-mail: chantinee@smartss9168.com).

Suphamit Chittayasothorn is with the Department of Computer Engineering, Faculty of Engineering, King Mongkut’s Institute of Technology Ladkrabang, Bangkok, Thailand (e-mail: suphamit@kmitl.ac.th).

This is due to doctors in Thailand being recognized as experts and experienced in terms of cosmetic surgery, and due to the rates of services being reasonable and affordable, compared to the United States, countries in Europe, or even Asia countries. In addition, there are many famous tourist attractions and interesting cultures, with convenient accommodations for a good rehabilitation after the medical tourists have had the medical services, such as quality hotels with reasonable rates, delicious and famous cuisines, and Thai people are friendly and able to provide very good service to the tourists [2].

The medical tourism industry in Asia is growing continuously, especially in Thailand. In 2015, there were 2.5 million foreign medical tourists who had medical services in hospitals and clinics. Fig. 1 shows the number of medical tourists & the estimated revenue generated that increased in number in every year. Although Malaysia and Singapore promote medical tourism as well, which means that the tourists have more choices to look for medical services, [3] but a number of the tourists who visited Thailand from 2009 to the second quarter of 2015 (April-June) are continuously increasing as shown in Fig. 2 [4].

No. of medical tourists & Estimated Revenue generated			
	2010	2011	2012
No. of medical tourists (person)	1,980,000	2,240,000	2,530,000
Estimated revenue (Mil Baht)	78,740	97,874	121,658 – 140,000
Top 5 Medical Tourists by nationality	1. Japan 2. ASEAN 3. Middle East 4. US 5. UK	1. Japan 2. ASEAN 3. Middle East 4. US 5. UK	1. Japan 2. US 3. UK 4. GCC 5. Australia

Sources: Ministry of Public Health, Thailand and Kasikorn Research Center
Compiled by www.myMEDholiday.com

Fig. 1. Number of medical tourists & estimate revenue generated [3].

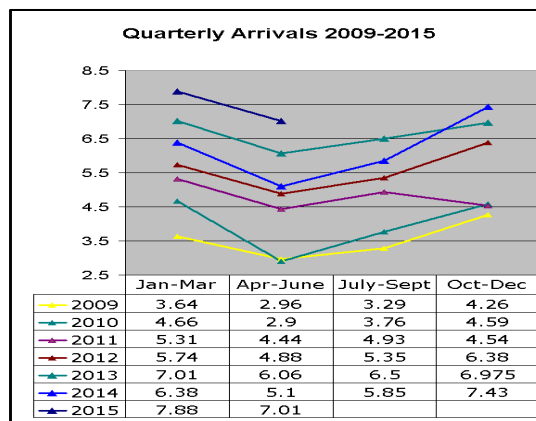


Fig. 2. Quality Arrivals (in millions) Thailand, 2009-2015 [4].

In this breakthrough growth of medical tourism industry, a factor required for hospitals and clinics to provide quick service and accurate data is information systems. We can say that information systems is another major factor, apart from the expertise of doctors, advanced medical technology, and reasonable rates of services to provide a successful service of medical and wellness tourism.

There are several information systems that can be applied to administrate the medical and wellness tourism business, such as POS for Cosmetic clinic [5], Izpal clinic 5+ [6], and Aristo Clinic [7].

The key features of cloud computing is reducing costs and number of investments of any company with a multi-user system in the basic structures of server, computer, network, etc., which is why information systems cloud computing is popular in use for administration of medical and wellness tourism businesses nowadays.

II. CMS-SMSS

CMS-SMSS (Clinic Management System of Smart Solution and Services) is a clinic management system that operates on a private cloud. Fig. 3 shows CMS-SMSS network diagram and Fig. 4 shows CMS-SMSS architecture.

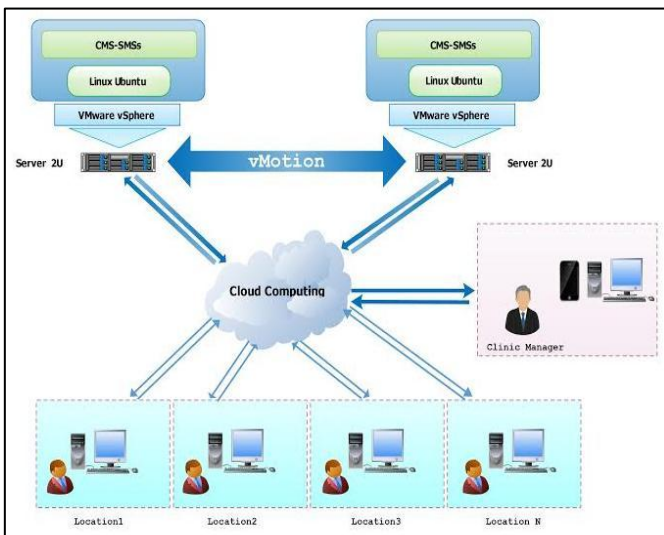


Fig. 3. CMS-SMSS network diagram.

CMS-SMSS works on a visual machine system of VMware through the VMware and vSphere with the operating system LINUX Ubuntu 14.04. CMS-SMSS is stored in one server while users are working. When a server has a problem or an auto-fail, CMS-SMSS will be transferred to another server immediately with the VMware vMotion function, while the CMS-SMSS is still running, so the users can continue working. Therefore, the CMS-SMSS is a system with very high security.

CMS-SMSS was developed using the web applications HTML, JAVA and PHP (Laravel (5.1.1 on the Apache Web Server 2.4.7 by using the database management system MySQL 5.6.12 on LINUX Ubuntu 14.04 operating system. The system users of CMS-SMSS are composed of 2 parts: (1) Operation User, including sales staff, warehouse department, purchasing department, human resource department, and doctor, and; 2) Manager User, such as clinic managers or

owners. All users can access the system both on PC and Smartphone via available browsers such Internet Explorer, Chrome and Safari.

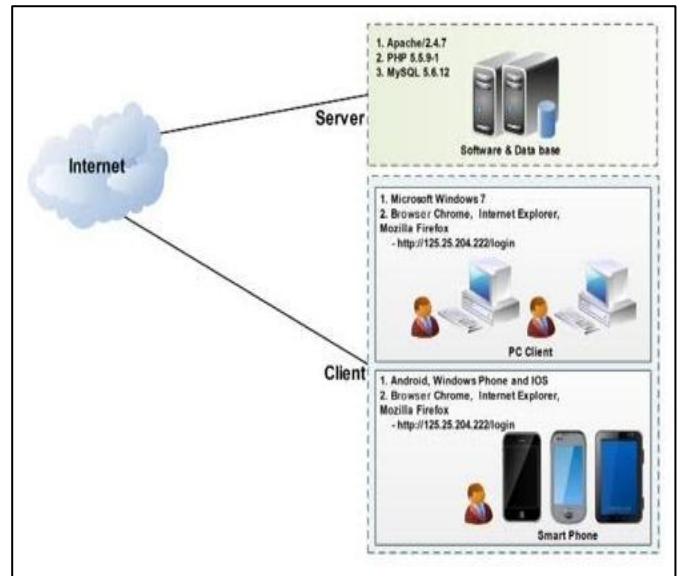


Fig. 4. CMS-SMSS architecture.

A. CMS-SMSS Boundary

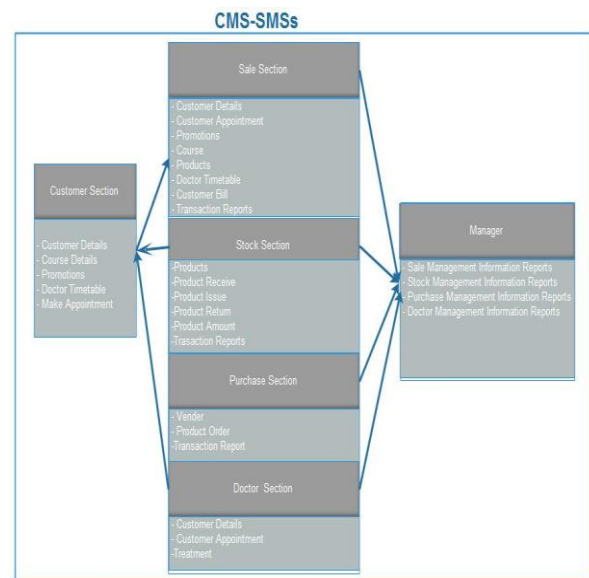


Fig. 5. CMS-SMSS boundary.

CMS-SMSS was designed to support both clients and service providers. CMS-SMSS working scopes consist of 2 parts: 1) client part. Clients are people who have received medical service in cosmetic clinic businesses, which have currently increased in terms of client numbers and this business brings high income to Thailand. In this part, the clients are able to access to the system to view several pieces of information, such as course details, promotions, product lists, doctor lists, doctor specialty lists, etc. Also, the clients can register to be a member of hospital or clinic, and can make an appointment depending on the doctor's schedules. If the clients are not available to register as a member directly with the system, they can still register with the customer service department in the clinic. 2) Service providers (hospitals, clinics), which consist of operation users, including sales, warehouse, purchasing, human resources,

and treatment departments. Each department works within the following scope: The sales department handles client data, products information, courses details, promotions information, stock information in the warehouse, and evaluates client's expenses. For the treatment department, doctors are able to retrieve client appointment data that was sent from the sales department, in order to provide the correct treatment. Then the doctors send the data to the system where the clients will be allowed to see the details of treatment, and

the system will send the data to the sales department in order to evaluate the client's expenses. For warehouse and purchasing departments, they are responsible for stock data, receiving products that were ordered by purchasing department. The main feature of CMS-SMSs for operation users is submitting all data to be processed (evaluated) by the manager user (clinic manager) for administration and decision-making, The data that the manager user needs can be sales volumes, income summaries, expenses reports, etc.

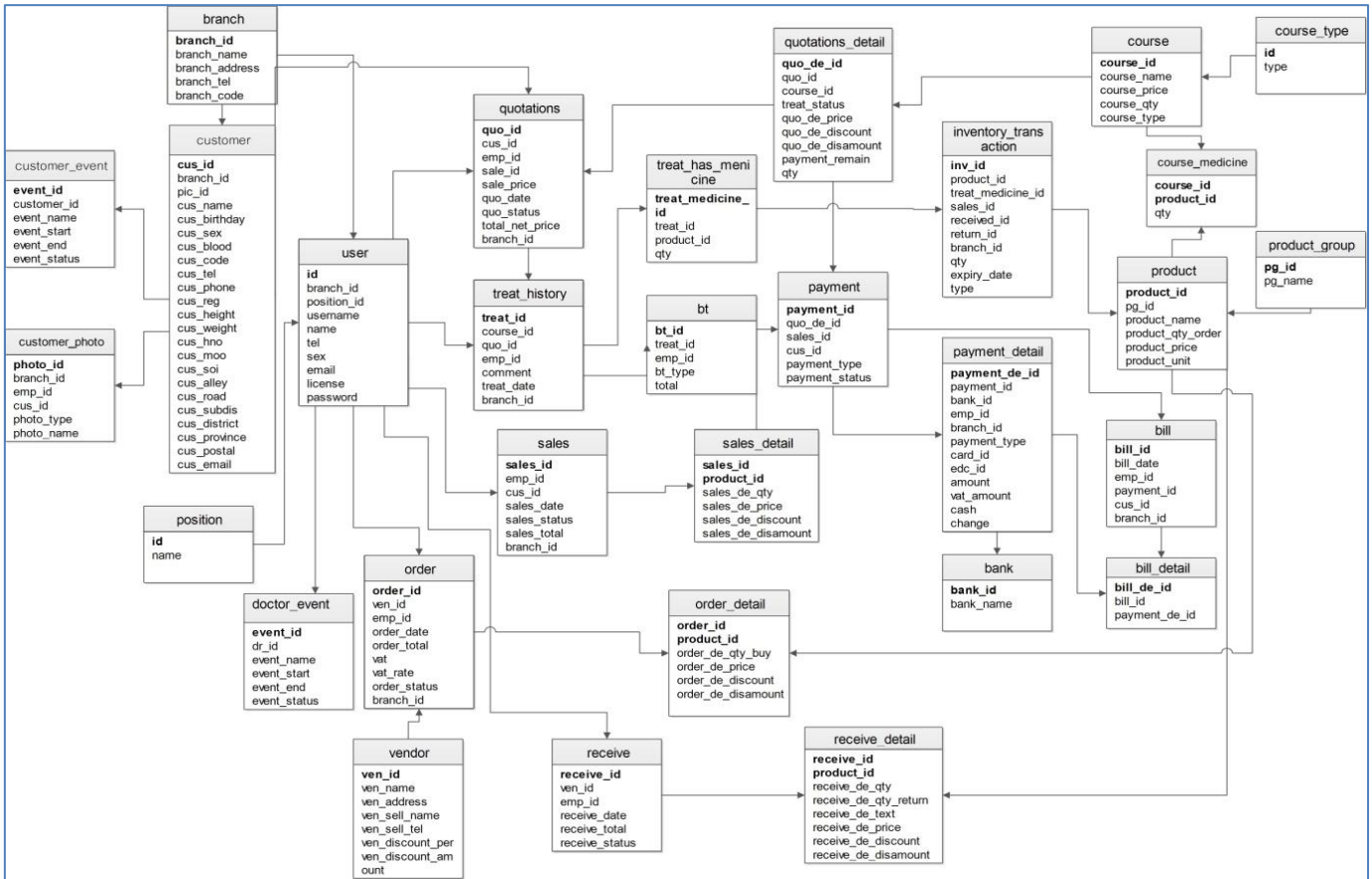


Fig. 6. CMS-SMSs — Database diagram.

```

1)
DB_HOST=localhost
DB_DATABASE=dbclinic
DB_USERNAME=root
DB_PASSWORD=

2)
DB_HOST= cluster_ip : cluster_port // IP port
DB_DATABASE=dbclinic // Data Base name
DB_USERNAME= cluster_user // Username of MySql
DB_PASSWORD= cluster_password // Password of MySql

3)

'mysql' => [
  'driver' => 'mysql',
],
    
```

Fig. 7. Connection between PHP (Laravel Framework (5.1.1) and DBMS MySQL 5.6.12.

B. CMS-SMSs Database System

As mentioned above, CMS-SMSs was developed using web applications HTML, JAVA and PHP (Laravel 5.1.1) on the Apache Web Server 2.4.7 by using the database

management system MySQL 5.6.12 on LINUX Ubuntu 14.04 operating system. CMS-SMSs is a clinic management system that runs on a private cloud database diagram. Figure 6 shows the database diagram of CMS-SMSs following a system scope shown in Fig. 5.

The connection between PHP (Laravel Framwork 5.1.1) and DBMS MySQL 5.6.1 of CMS-SMSs is shown in Fig. 7. It consists of 3 steps, as follows: Step 1) edit file. ENV is a file to connect to DBMS MySQL, Step 2) cloud connecting procedure, by using username, password, and IP Port from the rental of the MySQL Cloud to connect, Step 3) assigns PHP (Laravel Framework) as the database application.

C. CMS-SMSs-User Interface

Screen designing for CMS-SMSs application is based on convenience for the user. This edition is a Thai version, and we will develop an English version in the future, in order to support of wider range of users. Users can log in to the system by all kinds of browsers. Fig. 8 shows main menu screen, Fig. 9 shows a sample of the clinic course administration screen, and Fig. 10 shows a doctor's screen.

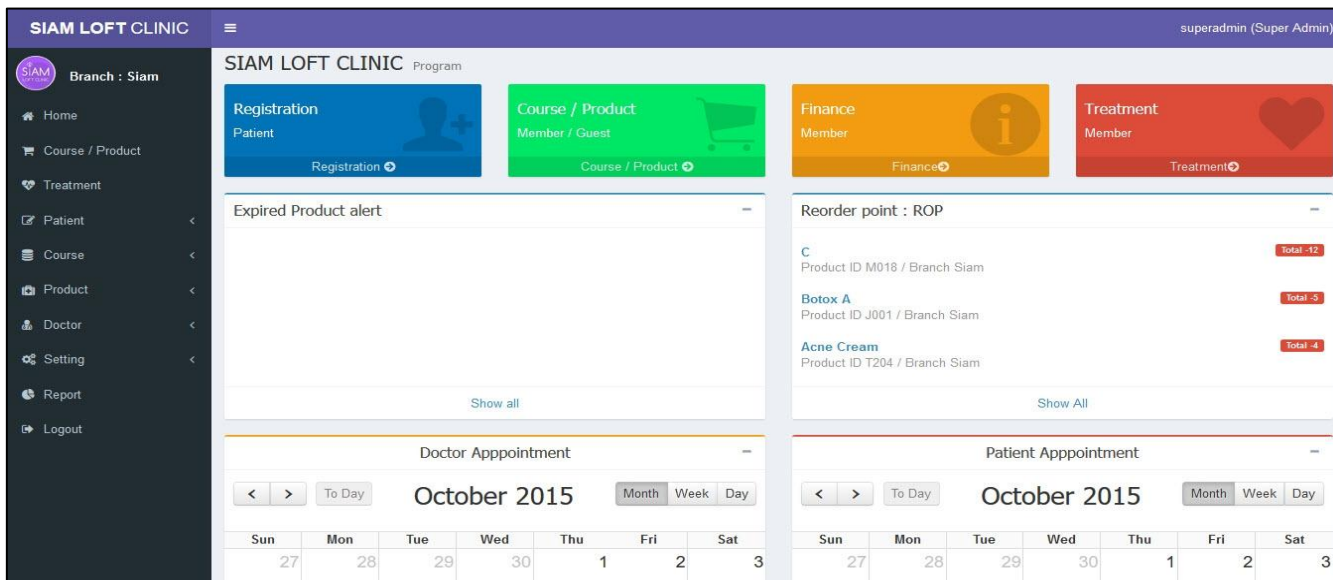


Fig. 8. CMS-SMSs — Main menu screen.

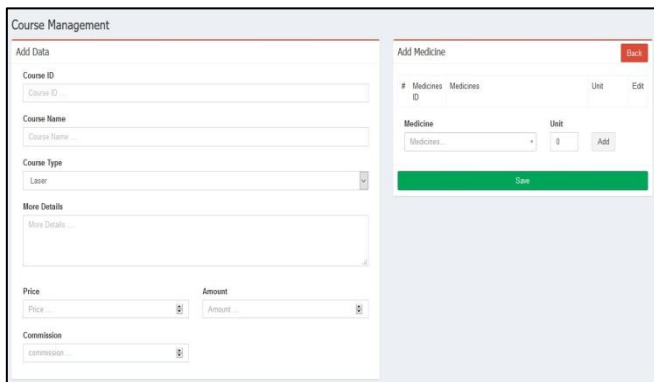


Fig. 9. CMS-SMSs — Course management screen.

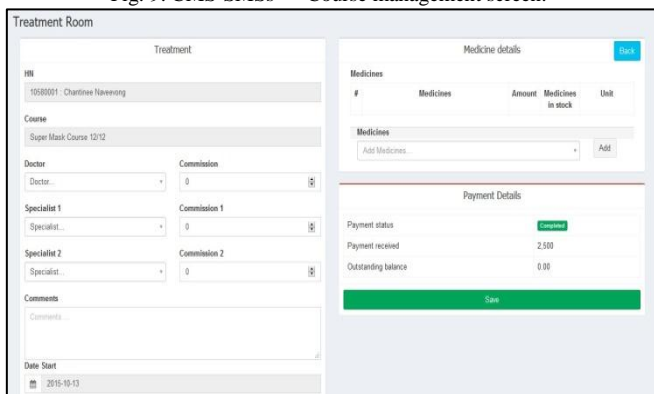


Fig. 10. CMS-SMSs — Treatment screen.

III. BENEFITS OF CMS-SMSS ON CLOUD COMPUTING

With an economic crisis in many countries nowadays, so all businesses have to minimize costs, but still have to maintain quality. Currently, information systems are important for running all businesses, but some companies can't afford information system investments. Cloud computing is an alternative solution to reduce the cost of information systems investments. The cloud computing works on a network, so investments in a server or local network is not required.

The CMS-SMSs works on cloud computing, as stated above. All users can access the system via PC, Tablet,

Smartphone by logging in to the system via Browsers mentioned above.

The advantages of CMS-SMSs are as follows: it is suitable for beauty clinic management available for connecting online and real-time. It works on cloud computing, which makes it easily for clinic management, and is suitable for businesses with multi points of sales, and multi branches. It runs on MySQL , and has a high capacity for a lot of data, with quick and accurate processing, allowing uses to arrange data, such as Insert, Update or Delete via the Internet any time, and is also available for Touch screen application.

IV. CONCLUSION

Thailand is a major destination for tourists from all over the world, since there are various beautiful attractions with dominant cultures and many festivals, delicious and famous cuisines, comfortable accommodations with friendly and very service-minded Thai people. Also, the price for travelling in Thailand is reasonable and worthwhile.

Medical tourism is a part of Thailand's tourism that is growing rapidly because Thailand is famous in terms of the expertise of doctors with advanced technology and medical tools, and reasonable rates of medical services. Thailand is also a very nice place for rehabilitation after treatment as there are many options for traveling places, as mentioned above.

As information Systems is one of the key factors for success of all businesses nowadays, the CMS-SMSs was developed to administrate beauty clinic businesses. It works on a cloud computing where all users (clients and service providers) are able to access the system via all kinds of browsers.

REFERENCES

- [1] TourismThailand. (August 20, 2015). Thailand Health & Wellness Tourism Showcase 2015. [Online]. Available: <http://www.tatnewsthailand.org/detail.php?newsID=4047>.
- [2] B. MED. (August 20, 2015). Cosmetic Surgery in Thailand. [Online]. Available: <http://www.cosmeticsurgerythailand.com/>.

- [3] Mymedholiday. (August 20, 2015). Thailand's Medical Tourism Statistics: a Look at the International Patient Numbers. [Online]. Available: <http://www.mymedholiday.com/blog/2013/10/793/thailands-medical-tourism-statistics-a-look-at-the-international-patient-numbers/>.
- [4] ThaiWebsite. Tourism Statistics Thailand 2000-2014. [Online]. Available: <http://www.thaiwebsites.com/tourism.asp>.
- [5] Plusma, *POS for Cosmetic Clinic*, August 28, 2015.
- [6] Izpal, *Izpal clinic 5+*, August 28, 2015.
- [7] A. Soft. (August 28, 2015). Aristo Clinic. [Online]. Available: <http://www.aristosoft.org/clinic/>.

Pusadee Pornphol is an assistant professor at the Department of Computer Science, Faculty of Science and Technology, Phuket Rajabhat University, Phuket, Thailand. She received her B.S. in computer science from RU, M.S. in information technology from KMITL, Thailand and Ph.D. in information systems from Victoria University, Melbourne, Australia. Her current

research interests include strategic information systems in tourism and database systems.

Chantinee Naveevong is a CEO at Smart Solution and Service Co., Ltd., Samutprakarn, Thailand. She received her B.S. in computer science from Phuket Rajabhat University, Phuket, Thailand Her interest is network technology and security.

Suphamit Chittayasothorn is an associate professor at the Department of Computer Engineering, Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang (KMITL), Bangkok, Thailand. He received his B.Eng. in computer engineering from KMITL, M.Eng. in computer technology from the Asian Institute of Technology (AIT), Thailand and Ph.D. in computer science from the University of Queensland, St.Lucia, Brisbane, Australia. His research interest is database systems.