The development of Knowledge management system for local wisdom invention preservation.

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Abstract
Thailand has various inventions that derive from various important local wisdom, which were knowledge passes on from generations to generations. Together with the passing of knowledge, adaptation and changes were made. This led to local wisdom as appropriate to the socio-cultural environments. Such inventions would disappear without proper conservation effort. Therefore, efforts to consolidate, record, and conservation such local wisdom should be made to ensure applicability to various situation today. In addition, local wisdom can be used as the basis for the development of local jobs. Therefore, science and technological advancement today could be applied to further develop the production, marketing, management, and conservation of such local wisdom and inventions. The researcher has developed the Knowledge management system for local wisdom invention preservation through the development of application with online database using Unified Modeling Language in helping the design of the system. The system can collect knowledge data or local inventions. The collection is made from eminent persons sharing the content and pictures about the invention. The database becomes learning site about local inventions. In addition, it provides ways to further spread the knowledge to the next generations of youth. The system was assessed on its effectiveness using Black Box Testing technique with 2 groups expert with the assessment result at good level ($\bar{X}$=4.30, S.D. =0.28), and ordinary users with the assessment result at good level ($\bar{X}$=4.21, S.D. =0.37). The system can be implemented in real-world situations.

Keywords
Knowledge, Local wisdom, Conservation, Thai Kite

1. Introduction

Local wisdom and associated inventions are considered the pride of the community as it has been developed and passes on from old generations to new generations for example of the Thai Kite which is the case study in the development of the system. In the Thai historical records, there were records of King Phra Ruang play the Kite just like ordinary persons. As time went on, Kite had become so popular that there were royal decree forbidding the playing of commoner's Kite over the palace area [1, 2]. Nevertheless, as the world is changing, the wisdom of Thai Kites has been facing difficult situation due to the decrease of inheritors. The knowledge passed on from one generation to the next is also disappearing. Furthermore, there has been no real interest from any department or individuals, and the conservation is being conducted in very small circle [3]. The researcher notices the importance in the management of knowledge

regarding the conservation of Thai kite, as the conservation is essential to the preservation of the local wisdom [4]. The process in the knowledge management had to be done in the correct way in order to gain knowledge from actual practices [5]. Information technology may play a crucial role in knowledge management [6], both in term of storing and categorizing data, but also in term of the promotion of such knowledge as well. Based from the researcher's experiences in development of various information system, it can be found that information system could help in the organization of data effectively [7]. Therefore, the researcher has developed Knowledge management system for local wisdom invention preservation with the main objective in organizing the steps in the preservation and conservation of local inventions.

1.1 Research Objectives

- To develop the Knowledge management system for local wisdom invention preservation.
- To conduct evaluation of the effectiveness of the system from experts and users.

1.2 Research Range

- The developed system is a mobile application that can be used on android operating system
- System administrator can manage the expert information and identify access rights to the project for conservation of local inventions
- Expert can manage the information and pictures of the project for conservation of local inventions, and can answer questions about project for conservation of local inventions
- General user can access information about project for conservation of local inventions and post questions about the project.

2. Research methodology

The implementation of collecting data which related to an invention of Thai Kite. We have collected the data from indigenous people and those who are associated in making a traditional Thai Kite. They are located in Bang Nang Li, a sub district of Amphawa, Samut Kongkharm, Thailand. A man made Kite is well-known to people from this area and our researcher has an opportunity to those people who keep this Thai tradition all along these years. We also make a research based on their documents and collecting all the data by using technology to assist the researcher on developing an effective system. The development of the system will this new technique for analysis and design of the object that uses the language UML (Unified Modeling Language) to help a designing work into 2 sections: 1. Architecture Design 2. Detail Design

2.1 Use Case Diagram

Shows the functioning of the system that consist of Actor which is the user of the system, and Use Case that shows the function of the system [8]. The two parts will be linked and showed relationship in **Figure 1**. It can be seen that there are 3 levels of user access rights: 1) Administrator, Specialist, and User. Each user would have different function as specified in the work.

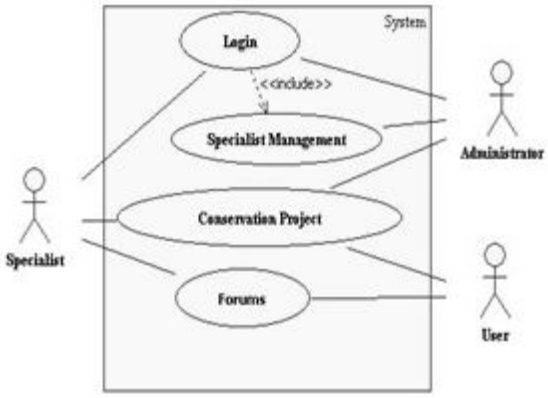

Figure 1 Figure's Use Case Diagram

- Administrator would login the system and manage the specialist and determine access rights for conservation project.
- Specialist would login the system and add information and pictures of each conservation project and answer questions about each project.
- User would recall information about conservation project and post question about conservation projects.

2.2 Class Diagram

Class Diagram would show the relationship and structure of the system, and can learn about the

component and class for each diagram [9], the class diagram is shown in **Figure 2**.

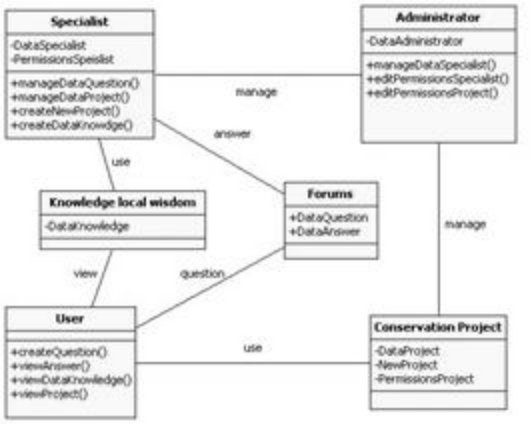

Figure 2 Figure's Use Class Diagram

- Class Administrator consist of Attribute (Data Administrator) which is the information of the administrator, Method (manage Data Specialist) that manages the information about specialist, edit Permission Specialist that identify the access right of each specialist and edit Permissions Project that identify the access to conservation project
- Class Specialist consist of Attribute (Data Specialist) which is the information about the specialist, Permission Specialist is the information about the access of the system, manage Data Question which would answer user's question, manage Data Project would manage information about the project, create New Project would add new project and create Data Knowledge would add knowledge information about the project.
- Class User would consist of creates Question which would post question to specialist, view Answer would recall answer from specialist, view Data Knowledge would recall knowledge information, and view Project would recall information about projects.
- Class Conservation Project consist of Data Project which is the information about the projects, New Project is the information about new projects, Permissions Project is the information about access right to the project
- Class Knowledge local wisdom consist of Data Knowledge which is knowledge information
- Class Forum consist of Data Question which is the questions posted, and Data Answer which is the answer.

2.3 sequence diagram

It shows the function of the system with Object and time as the identification of sequence and focus on the instant of object sequence diagram. The diagram shows interaction between object based on the sequence of instance that occur. The massage between classes would led to the creation of method in the relevant class [10]. The research present example sequence diagram as shown in **Figure 3**.

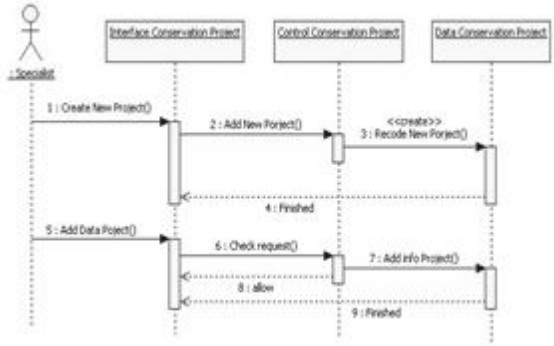

Figure 3 Figure's Use sequence diagram

Figure 3 shows the process of adding new conservation project and adding conservation project information with 1) access right and the flow is as follows: Specialist adds new project via interface projector, 2) interface conservation project send the request from specialist to Control Conservation Project, 3) Control Conservation Project add new project into the database Data Conservation Project, 4) Data Conservation Project would notify the specialist of completed record information. 5) Specialist add information about conservation project via Interface Conservation Project, 6) Interface Conservation Project check access rights for each project, 7) Control Conservation Project add information, 8) Control Conservation Project confirm the access to information, 9) Data Conservation Project notify specialist of complete record

2.4 *Activity Diagram*

This part shows the detail of each activity in each use case and the relationship within each activity [11]. The design use activity diagram and is now presenting sample of diagram with

decision-making or with options as shown in **Figure 4**

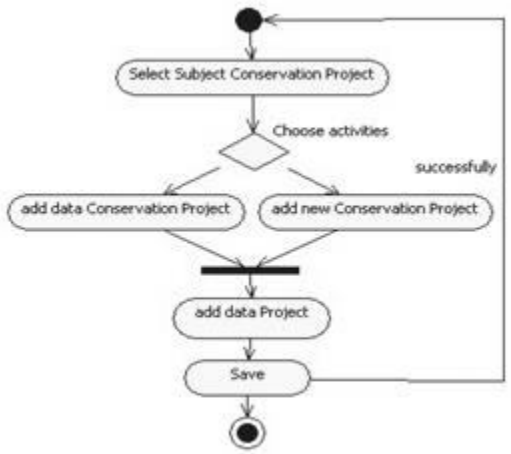

Figure 4 Figure's Use Activity Diagram

Start the following activities. 1) The experts were login access system.2) Select the requirements such as adding information on new conservation projects or conservation projects. 3) When selecting your needs already needs to be done to save the data.4) When the recording is complete, the system will reply to the experts that performed the procedure successfully.

2.5 Data Design

Is the design structure to store data that is used in the entire system. The store is in a relational database. (Relation Model) Because the data changes all the time, way researchers see appropriate for use. Relational databases [12], the researchers have proposed. ER-Diagrams Relational databases, the researchers have proposed. So users can look at the pictures of the data in the system more clearly. Use ER-Diagrams This helps to explain As shown in **Figure 5**.

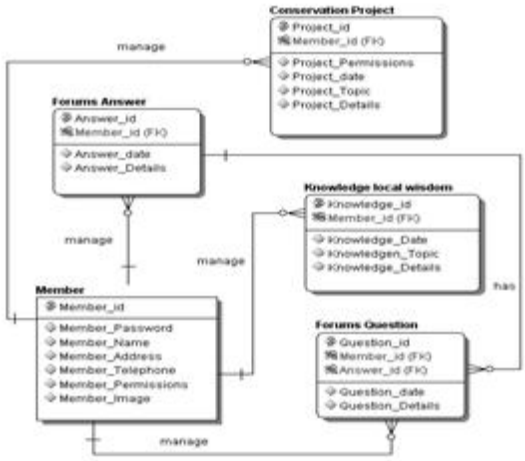

Figure 5 Figure's Use Data Diagram

- Table Member data collection Administrator and Specialist consist of Password ,Name, Address, Telephone, Permissions, and link Image. by Member id is Primary Key
- Table Conservation Project The conservation of data storage, consisting of Permission, Date, Topic, and Details by Project id is Primary Key and Member id is Foreign key
- Table Knowledge local wisdom The conservation of data storage, consisting of Date, Topic and Details by Knowledge id is Primary Key and Member id is Foreign key
- Table Forums Question Data questions from users in general. Consist of Date and Details by Question id is Primary Key have Member id and Answer id is Foreign key
- Table Forums Answer Data out of experts. Consist of Date and Details by Answer id is Primary Key and Member id is Foreign key

2.6 Evaluation of system effectiveness

Following steps are how to evaluate the accuracy of the system performance: The selected tools to evaluate the program's capability, method and evaluation process are through a questionnaire. The developer has selected test methods. Black Box Testing The test focused on the accuracy of input. (Input)And the results (Output) of the system as the main tool used in the assessment of the efficiency of the system [13]. Select the use is to ask to evaluate the effectiveness of the methods and steps to create a program evaluation.1) Data from the study to create the evaluation 2) Questions were further improved and modified to conform to the system. The program's performance measurement procedure to evaluate the performance of the program by

a 5 person of experts and users 20 person steps, as follows: 1)The invitation to test for evaluating the performance of the system and test day. 2) To start using the system, and tested the various aspects of a given estimate. 3) If an error occurs, the system works. Or suggested in the testing phase, the system was modified to make the system work more efficiently. The criteria to evaluate the effectiveness of the program in the evaluation by the experts and users in General is divided into 5 aspects: 1) Evaluation of the Functional Testing 2) Evaluation of the Functional Requirement Testing 3) Evaluation of the Usability Testing 4) Evaluation of the Security Testing 5) Evaluation of the Performance Testing. The researchers defined criteria include scale 5 level. (Rating Scale) To assess the effectiveness of programs in both quality and quantity can be divided into five levels: the following. The score range 4.50 - 5.00 Ina very good level. The score range 3.50 - 4.49In a good level. The score range 2.50 – 3.49 at the moderate level. The score range 1.50 - 2.49 at the low level. The score range 1.00 - 1.49 At the level of the minimum. The recognition efficiency of the system is developed by considering the average score of the expert group and the general user. The test system must have an average level (scores range from 3:50 to 4:49) to accept that the system is effective to use in actual working conditions as defined scope.

2.7 System Sitemap

Schematic representation of the system used to describe the operation of the system to be able to understand the process of the overall system. As shown in **Figure 6**

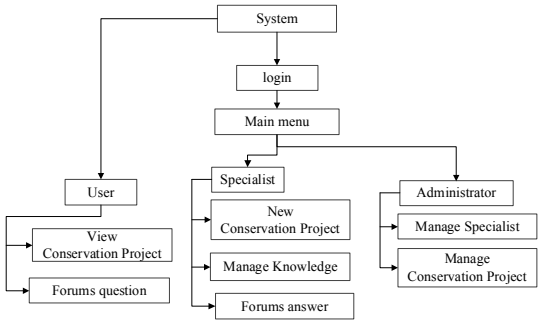

Figure 6 Figure's System Sitemap

System Sitemap to describe a process as follows. 1) Administrator login to access the system. Data management specialist and assign access conservation projects 2) Specialist login to access the system. Increase knowledge of conservation. And answers the questions of the general user. 3) The user must login to gain access to the system. Browse projects to conserve and to ask the questions.

3. Operation performance

From the educational process problems. Analysis of the design of work systems. Until the development of a knowledge management system to conserve artifacts from local wisdom. Can summarize the steps of research follows. Use HTML 5 is in the application. After that, it will have to evaluate the effectiveness of the system in which the results of research are proposed as follows: Research and development of knowledge management systems, conservation of artifacts from local wisdom is divided according to the user's privileges. Divided in 3according to the characteristics of the system users.

- Administrator can manage the data experts and can be assigned access to project the display, conservation, **Figure 7**.

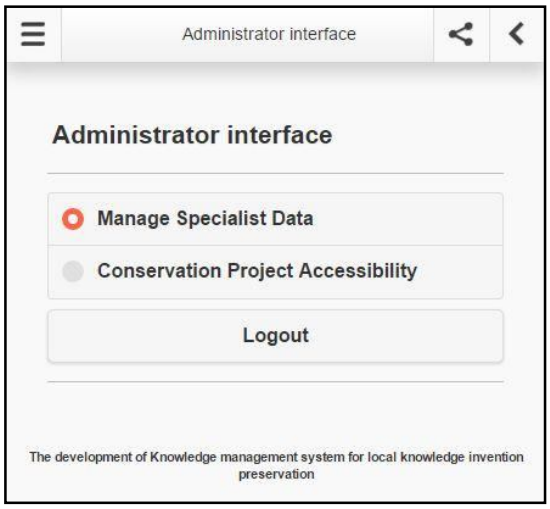

Figure 7 Figure's Administrator interface

- Specialist can add picture of the conservation, project of the conservation, giving information of operating conservation and answer to question as shown in **Figure 8**.

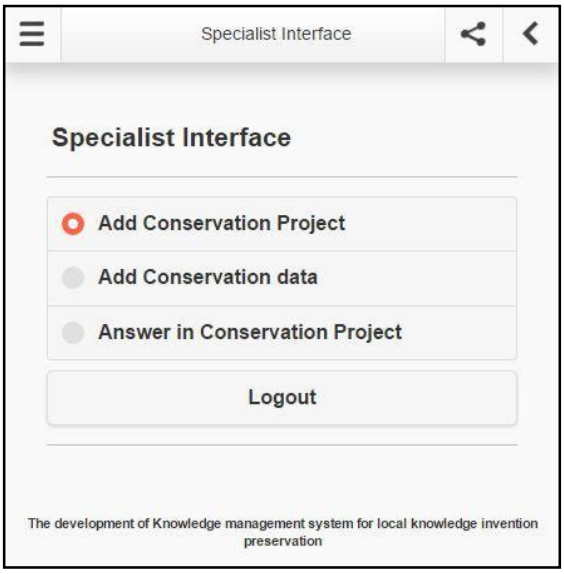

Figure 8 Figure's Specialist interface

- General User can browse information on conservation projects and ask questions in the conservation project has shown in **Figure 9**.

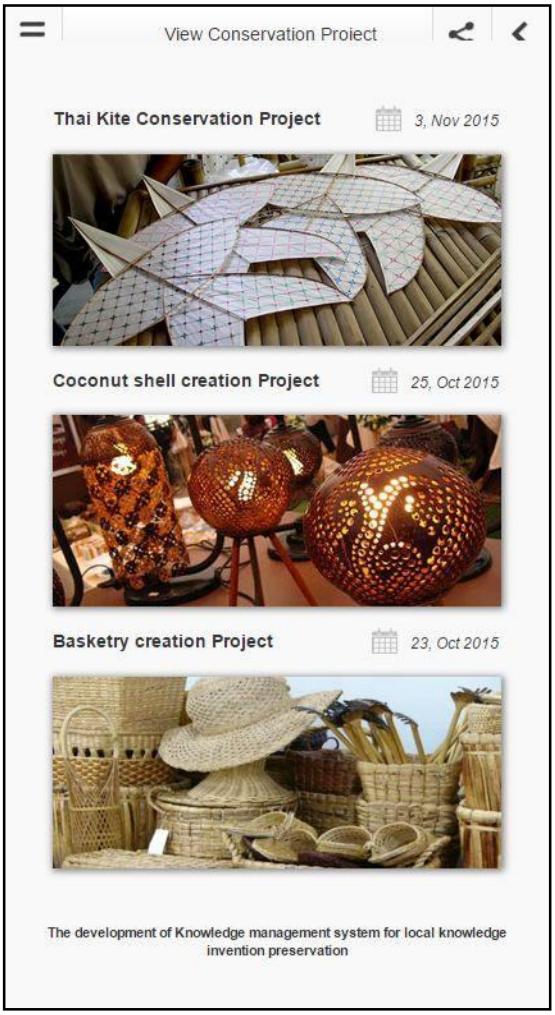

Figure 9 Figure's General User interface

4. Result and Discussion

The following 2 evaluator groups are used in the System Performance Evaluation: 1) Software specialists and Conservation specialists = 5 person and 2) a group of 20 users. Following are the evaluation outcomes summary: System performance evaluation by specialists shown performance is "Good" ($\bar{X}$ = 4.30, S.D. = 0.28), where all 5 criteria are "Good" as shown in **Table 1**. System Performance evaluation will use 2 groups of evaluator, 1) Software specialists and Conservation specialists: 5 persons. 2) 20 Users The results of evaluation as followed;
System performance evaluation by specialists shown performance is "Good" ($\bar{X}$ = 4.30, S.D. = 0.28), where all 5 criteria are "Good" as shown in **Table 1**.

Table 1. System performance evaluated by Specialists

No.	Criteria	$\bar{X}$	S.D.
1	Functional Testing	4.4800	0.22804
2	Functional Requirement Testing	4.2400	0.32863
3	Usability Testing	4.3200	0.22804
4	Security Testing	4.2400	0.47749
5	Performance Testing	4.2000	0.44721

System performance evaluation by General user shown performance is "Good" ($\bar{X}$ = 4.21, S.D. = 0.37where all 5 criteria are "Good" as shown in **Table 2**.

Table 2. System performance evaluated by General Users.

No.	Criteria	$\bar{X}$	S.D.
1	Functional Testing	4.2600	0.36187
2	Functional Requirement Testing	4.0600	0.49884
3	Usability Testing	4.1500	0.45364
4	Security Testing	4.3300	0.35109
5	Performance Testing	4.2300	0.53222

The objective of The development of knowledge management for conservation of artifacts from local wisdom is to improve the system for data storing of valuable local artifacts conservation knowledge, where many studied has shown the effort to systematically data storing [14, 15], as well as, becoming educational resources of local artifact conservation known ledge for next generation. In accordance with the purpose of Thai Kite conservation which is valuable wisdom. The developing of the system uses object-oriented analysis and using UML language for design, while the HTML5 language used to develop applications.

5. Conclusion

Knowledge management is the knowledge from practical experience bring to realization the empirical knowledge that people will be able to take use for benefits, especially valuable local conservation of artifacts knowledge. The experience and conservation and preservation knowledge of Thai cultural heritage is indeterminable. Knowledge management system for information technology is a tool to preserved and shared with the public the next generation.

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References

[1] Saengchan Traikasem. (1986). Thai Kite. Bangkok Thailand: Amarin Printing.

[2] Lord Bhirombhakdi (Bunrod Sethabutra). (1921). Kite gambling legend. Bangkok Thailand: Sophon's.

[3] Arirat Phutthirungrot. (2014). Methods to Support Conversation and Inheritance of the Local Wisdom of Thai Kite. Journal Prince of Songkla University. Vol. 25. No. 2, May-Aug 2014.

[4] Nilsook, P. and Sriwongkol, T. (2009) The Development of Multi-weblog with Knowledge Management for Thailand's Higher Education. 2009 International Conference on Information and Multimedia Technology (ICIMT 2009) December 18-19, 2009: Jeju Island, South Korea. p. 315-318

[5] Anupan, A., Nilsook, P. and Wannapiroon, P. (2015). A Framework for a Knowledge Management System in a Cloud Computing Environment Using a Knowledge Engineering Approach. International Journal of Knowledge Engineering, Vol. 1, No. 2, September 2015. pp 146-149. DOI: 10.7763/IJKE.2015.V1.25.

[6] Piriyasurawong, P. and Nilsook, P. (2010). Web-based Training on Knowledge Managementfor Vocational Teachers in Thailand. Asian Journal of Distance Education.Vol 8, no 2, 2010.pp 65 – 71.

[7] Phuangkamnerd, S., Nilsook, P. and Thamrongviwanna, R. (2015). Digital Library Operating Management System by North Bangkok University. The sixth International e-Learning Conference 2015 (IEC2015), July 20-21, 2015,BITECBangna, Bangkok, Thailand, pp.132-139.

[8] Seidl, M., Scholz, M., Huemer, C. and Kappel, G. (2015). UML @ Classroom. Switzerland: Springer International Publishing. P. 23-47

[9] Tonella P. and Potrich, A. (2005). Reverse Engineering of Object Oriented Code. New York: Springer. P. 43-61

[10] Rosenberg, D. and Stephens, M. (2007). Sequence Diagrams. Doug Rosenberg and Matt Stephens: Apress. P. 185-231

[11] TripathyAffiliated, A. and Mitra.A. (2012). Test Case Generation Using Activity Diagram and Sequence Diagram. Proceedings of International Conference on Advances in Computing. Advances in Intelligent Systems and Computing. India: Springer. Vol.174. p. 121-129

[12] Manfred A. Jeusfeld. (2011). A Deductive View on Process-Data Diagrams. 4th IFIP WG 8.1 Working Conference on Method Engineering, ME 2011, Paris, France, April 20-22, 2011. Proceedings.

Engineering Methods in the Service-Oriented Context. Berlin Heidelberg: Springer. Vol.351. p.123-137

[13] Nidhra, S. and Dondeti, J. Black Box and White Box Testing Techniques –A Literature Review. (2012). International Journal of Embedded Systems and Applications (IJESA) Vol.2, No.2, June 2012

[14] Keoplang, P., Rungkasiri, T,.Sophatsathit, P.,andNilsook, P. (2011). Convergence of Mobile Learning Technology and Knowledge Management System Innovation for SME Clustering. Proceedings of the 6th International Conference on e-learning, pp. 468-476

[15] Phuangkamnerd, S., Nilsook, P., Thamrongviwanna, R., and Phuangkamnerd, S. (2015). Development of a knowledge management system restoration archaeological site. The 3rd International Conference on Technical Education November 26, 2015 Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Thailand.