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Applying of the Human-Centered Design Theory to Create a Mobile Application: A Case of Urban Transport System

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ABSTRACT

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Keywords: Transit Map; Mobile Application; Human-Centered Design (HCD); Way-Finding; Maha Sarakham

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APPLYING OF THE HUMAN-CENTERED DESIGN THEORY TO CREATE A MOBILE APPLICATION: A CASE OF URBAN TRANSPORT SYSTEM

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Abstract

This research is the exploration and development of a mobile application and graphic mapping to support the public transport system within the Maha Sarakham downtown with an emphasis on the “Song Taew”, a type of passenger-transport service. Indeed, the public transport system has been provided around the province for over 20 years to serve more than 100,000 people a day. However, there is no a well-preparation of guiding information service to aid the travelers to understand and learn more about the transporting routes that that should lead them to their desired destination. Particularly in this research, a “Human Centre Design” theory (HCD) was applied to construct the conceptual framework in order to support the research methods and to form up the stakeholder’s knowledge-based community as the heart of a navigating application and graphic mapping development and design. Finally, the evaluation on efficiency and effectiveness of the transit map model with the expert groups’ satisfaction, the total score was high ($\bar{x} = 3.71$, $SD .841$) affirming that the application is practically effective and applicable for practical use and any associated further study.

Keywords: Transit Map, Mobile Application, Human-Centered Design (HCD), Way-Finding, Maha Sarakham

1. Introduction

Nowadays, the beginning of the ASEAN Free-Economic Area notably pushes forward the regional integrative and logistics development policy into the Northeast of Thailand to be known as the “East-West Economic Corridor (EWEC)” to connect 4 neighboring countries to one another including Myanmar, Thailand, Laos, and Vietnam so that the region automatically becomes one of the foremost strategic points and the main route for trading and logistics. Therefore, the upgraded transportation system is another critical issue requiring a rapid progress in order to effectively carry out the missions in an era of the ASEAN Economic Community (AEC) that is expected to happen in 2016 [1].

Geographically, Maha Sarakham is a province in the Northeast of Thailand and one of the foremost strategic points for the EWEC to transmit products and services to Laos and Vietnam. Maha Sarakham is also

a part of the government’s double-track railway plan so it is formally another key location in this part of the country.

In general, Maha Sarakham is well-known for being one of education center in the Northeast where all levels of education are provided. Besides, this province has a plenty of tourism resource, rich culture and tradition, and local life-style of the native Isan people. However, in term of the public transport (Song Taew), Maha Sarakham has no good guiding information service and different forms of media e.g. website, printed media, which are an important source of information for the people who want to either travel or do other activities. Indeed, while the province is stepping into the AEC, it soon would be a huge problem if this basic information providing service is still undeveloped.

Despite all of the above, the data from the site-visit with the people in the Maha Sarakham downtown indicates there are 5 routing systems of the Song Taew service

but the guiding information service is still lacking and not well-prepared to serve the local people and tourists but the fact is that this information should be a database for both local people and the visitors doing their business in the area.

Those problems previously mentioned encouraged the service user to informally do their data searching in which the researcher noted that they typically prefer “asking” rather than “reading” to get the directions by themselves. At this point, it has been affirmed that lacking the useful database for the public transport somehow casts the effect on the people’s behavior and their activities involved with their travelling around the downtown for different purposes such as trading, working, and taking a trip because doing an activity needs transportation. Consequently, it apparently suggests that developing an effective guiding information service can be a firm database for people to carry out their activities around the downtown [2], [3].

As a consequence, the researcher was encouraged to develop some kind of information system to support the public transport within the Maha Sarakham downtown and it was a mobile application with 2D barcode scan to provide the guiding information and printed map in order to connect the service user with the public transport. Particularly, the Human-Centered Design (HCD) theory was applied as the conceptual framework for the study and constructing a data set for the development of the graphic application on mobile with printed map in which the stakeholders were invited to participate and exchange their ideas during the data collection and also in the evaluation in order to prevent the possible errors and to create the effective mobile application with optimal communicative function.

By conducting this research, the researcher expected to create a specific participation pattern in designing and developing an application on the public purposes as well as to provide the useful information for the

public transport in order to prepare for the forthcoming AEC. Accordingly, the objectives of this research were to 1) explore and analyze general context of public transport service within Maha Sarakham downtown; 2) design and develop a mobile application with guiding information service using the HCD theory; and 3) evaluate the efficiency and effectiveness of the graphical transit map with the expert groups.

2. The Area of Study

According to general context of the public transport service in Maha Sarakham, there basically are 3 types of travelling including Type 1: personal transportation (car, motorbike), Type 2: Private transportation (taxi, tricycle, motorcycle taxi), and Type 3: Public transportation (Song Taew, See Figure 1). Specially, this research solely aimed to upgrade the guiding information service system for the Type 3 transportation or “Song Taew” because it is mostly popular amongst the local people and it is cheaper and simply accessible. Still, some key factors for this kind of service is absent and one of them is a routing service that requires the effective guiding information that has strong influence on the service user so that the service might become ineffective. On the contrary, this guiding information service will be helpful in catching up with the global changes and rapid-growing technology and more importantly to correspond to the Special Economic Zone Strategy in which Maha Sarakham province is one of the routes for the East-West Economic Corridor (EWEC) and also a part of the government’s double-track railway plan. For these reasons, the urban public transportation is undoubtedly necessary.



Figure 1. “Song Taew” Service in Maha Sarakham

2.1 HCD Approached in The Research

[4] stated that long before “Human-Centered Design (HCD) was invented, it used to the word “User-Centered Designed (UC)” that was rooted in “Usability Engineering”. Today, the HCD is being broadly mentioned as a guide to new product invention by engaging the stakeholder into the development process in order to create the best-quality product and service. Specifically, the Usability Concept of the HCD mainly looks at 3 variables including Efficiency, Effectiveness, and Satisfaction from the stakeholder within the system [5] and there are 4 main steps to follow as mentioned on an ISO 13407 and listed below [6].

- Define the context of use
- Specify the demands of service user and organization
- Find the solution for the production design problem
- Design the evaluation to suit the project

In fact, the HCD can be applied to solve various kinds of problematic designs by creating a model product to be tried out within an organization. Accordingly, the HCD is an important system that aids a designer to be more confident that the product has the best quality for the stakeholders, as the system users, within each section. Meanwhile, he can be assured that the project will smoothly achieve the goal. Besides, an ISO 13407 describes that the HCD is a repetition process perfectly designed for a model product test following the user’s demand.

As previously discussed, the HCD concept focuses on the stakeholder’s engagement into the system as the heart of the product development so the researcher purposively applied this concept for the development of the model application and graphic system and integrated additional ideas from all stakeholders, as the service provider and user in the public transport context, with the demand of the system developer in order to develop the authentically integrated product model. The final product was resulted as the application and graphic mapping system that are corresponding to the actual need of both service provider and users.

3. Participants

The sample group was classified into 3 groups as follows.

Group1: Government Officer: (1) Mayor of Maha Sarakham, (2) Director of Tourism Department, Maha Sarakham, and (3) Director of Maha Sarakham Provincial Land Transport Office. These participants were chosen by purposive sampling.

Group2: Expert Groups: (1) Graphic Design And Application (2) Urban Design (3) Transport Engineering

Group3: Local People: (1) Students (elementary, secondary, university), (2) Working age, (3) Elderly people, (4) Extras (Buddhist monks, handicapped), and (5) Son Taew owners. Each group consisted of 20 people so it was totally 100 participants. These were selected by accidental sampling

4. Methodology

This research was based on the Human-Centered Design (HCD) framework following an ISO 13407 and the methodology was classified into 3 main stages as below.

4.1 Stage 1 (Pre-Design) Data Collection

Literature review: the researcher did a document study on various issues e.g. the mass transportation concepts, Maha Sarakham context, the public transport within the target area, etc. The study was also conducted on the associated theories

that were applicable for the design process such as information system design, 2D barcode, mobile application design, human factors, and Human-Centered Design.

Observation: Later, the researcher did site-visit to observe the preparation on guiding information service and investigate the behaviors of the service provider and user. After that, more data was collected from the interview with the key informants.

In-depth interview: the interview was done with different groups of key informants including 1) Government Officer: Mayor of Maha Sarakham, Director of Tourism Department, Maha Sarakham, and Director of Maha Sarakham Provincial Land Transport Office; and 2) Specialist: Transportation engineer, Urban design specialist, and culture and art specialists.

Questionnaire: the questionnaire was provided to the local people as the service user of the public transport including 1) Students (elementary, secondary, university), 2) Working age, (3) Elderly people, 4) Extras (Buddhist monks, handicapped), and 5) Son Taew owners.

Data analysis: During Stage 1, each data collection methods provided different set of data including the variables from content analysis, documents, literature review, and observation, the variables from typological analysis, in-depth interview, and the variables from frequency analysis, and questionnaire. All data was processed to define the bond that was later triangulated to compare different data from different sources that made them more accurate and reliable [7].

4.2 Stage 2 (Post-Design) Data Collection

Based on the outcomes from document study and interview with the key informants, the researcher created a model application and had it verified by the specialists from different associated fields including 1) Graphic design And Application, 2) Urban design, and 3) Transport engineering in order to ensure if the model application was able to communicate meaningfully through the

graphic content. In this regard, the Usability Test (ISO: 9241) was used as a universal principle for the media efficiency (definition, proper functionality), effectiveness (comprehension, vision), and satisfaction (attractive display).

Data Analysis: the result from the Usability Test was later analyzed in 3 aspects including 1) Efficiency: an evaluation on physical appearance and correct ratio of graphic content; 2) Effectiveness: an evaluation on the participant's understanding toward the content, symbolic interpretation, direction reading, and tool use; and 3) Satisfaction: an evaluation on attractive display, color and font use matched with the service user's satisfaction. To be exact, the data was processed by frequency analysis with rating-scale selection [8].

4.3 Research Findings Stage 1

Finding 1: According to the in-depth interview with the Government Officers including 1) Government Officer: Mayor of Maha Sarakham, Director of Tourism Department, Maha Sarakham, and Director of Maha Sarakham Provincial Land Transport Office; and 2) Specialist: Transportation engineer, Urban design specialist, and culture and art specialists, it was found that the symbol of Maha Sarakham through the eyes of those key informants was "Phra That Na Doon".

Finding 2: According to the site-visit, it was affirmed that there are 4 routes of Song Taew service running around Maha Sarakham downtown including 1) Route 1: Crops market – Provincial Prison; 2) Route 3: Mahasarakhan Rahabhat University – New City Hall; 3) Route 4: Mahasarakham University (Khamriang Campus) – Mahasarakham University (Downtown Campus); and 4) Route 466: Bus Station - Mahasarakham University (Khamriang Campus). Total number of the main stop is 15.

Finding 3: In term of the Song Taew routing design, specific colors were used for each route and they were mixed with the local

uniqueness of Maha Sarakham that is “Soi Dok Mak Silk” following the in-depth data suggested by the famous icons in the province. (See Figure 2)



Figure 2. Dok Mak flower (right), Soi Dok Mak Pattern on Silk (left)

Finding 4: Based on the questionnaire data from the local people, different needs of the service provider and user could be discussed as follows: time schedule should be clearly displayed at the stop point telling the upcoming route number and arrival time; the map of each route with the highlights along the route should be presented at the bus station, more stop points should be provided; the time schedule needs to be clearly explained; the application should tell the history of each highlight; recommended restaurants, and how to reach the place especially for the tourists; parking area needs to be restrictedly defined; types of services along each route should be suggested with notable sign; and the route number should be clearly presented on the Song Taew.

4.4 Design Output Stage 1

According to the research outcome, the key concept of the design could be obviously defined. Generally, the symbol of “Maha Sarakham City” is “Phra That Na Doon” and Soi Dok Mak Silk. These unique products can be used to create the key concept for the design of the mobile application to support the public transport within Maha Sarakham downtown. The logo was a simply but modernly duplicated image of “Phra That Na Doon” and “Soi Dok Mak Silk” was redesigned into a graphic pattern mixed with the colors of the Song Taew. More importantly, this research not only creates a product but also promote

learning the lifestyle and identity of the local people. (See Figure 3 and 4)



Figure 3. The overall designs based culture studies

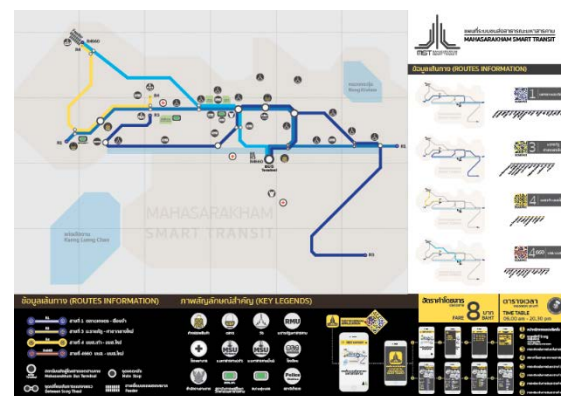


Figure 4. The final draft of map prototype before testing

4.5 Research Findings Stage 2

This stage was a conclusion of the statistical data analysis used for the Usability Test on the efficiency and effectiveness of the mobile application as well as the participant's satisfaction toward the public transport mapping system on mobile. The test was conducted by the specialists in 3 associated fields including graphic design and application, urban design, transport engineering, and the result of descriptive statistics analysis was affirmed that the total score of the application's efficiency, effectiveness, and the participant's satisfaction toward the design was high ($\bar{x} = 3.71$, SD .841) (See Table 1).

Topic	N	Mean	SD.
Section 1 Sum evaluative score of “logo design”	3	3.54	1.193
Section 2 sum evaluative score of “map layout”	3	3.38	.872
Section 3 sum evaluative score of “route information”	3	3.83	.673
Section 4 sum evaluative score of “Key Legends”	3	3.98	.855
Section 5 sum evaluative score of “UI of application guidance ”	3	3.82	.614

Table 1: Usability Test Result Analysis by Specialist

Table 1 concludes the specialist’s suggestions on critical issues that need to be revised including the layout, the logo should be more communicative, more of the main route should be added and connected to the section map and route information, and the application user’s guide need to be redesigned as a real time one. Consequently, the application was finally redesigned properly following those suggestions and the HCD concept was used to create an appropriate process to evaluate any impacts of this research on the stakeholder’s demand and the result was expected to be useful for any further study (See Table 2).

Experts	Comments
1) Graphic Design And Application	The map layout need to add some name of places to make sure user can be able to locate themselves.
2) Urban Design	The logo need to a bit adjust to make it represent to the shape of “Phra That Na Doon pagoda”.
3) Transport Engineering	Some of map symbols on the map layout need to design related with the showing symbol in the map legends in the bottom section. The designer could re-arrangement the using step of the application to make it better comprehension. The designer could add the direction in the layout.

Table 2: Suggestions by Specialists

4.6 Design Output Stage 2

As suggested by the specialists at Stage 1, several designing problems were pointed out and modified including fixing a disconnection between the map symbols within Section Map and the Route information, rearranging the layout organization, adding more landmarks,

matching the Song Taew routes with correct colors, as well as proper size and font, and redesigning the symbols to be more communicative. More details were discussed below.

Design Output; Problem 1: The Song Taew on each route was particularly painted with 2 colors including Route 1: blue- white; Rout 3: blue- yellow Rout 4660: blue – orange; and Route 4: only yellow. Thus, the design was created to match with the actual color on the car to offer correct guiding information.

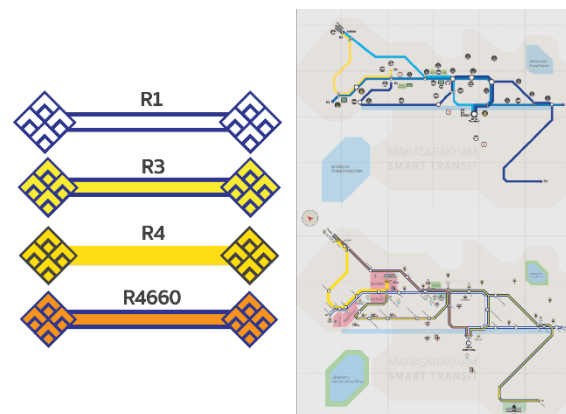


Figure 5. Design Output; Problem 1

Design Output; Problem 2: The symbols on the map were redesigned to clearly indicate the major locations e.g. shopping malls, universities, temples, hospitals, schools, police station, etc.



Figure 6. Design Output; Problem 2

Design Output; Problem 3: More of the landmark around the downtown were added including the new city hall, the clock tower, and Mahasarakham University Convention Hall.



Figure 7. Design Output; Problem 3

Design Output; Problem 4: The route information was redesigned with the font that was larger and more visible. Minor map was revised to match with the Section Map as well.

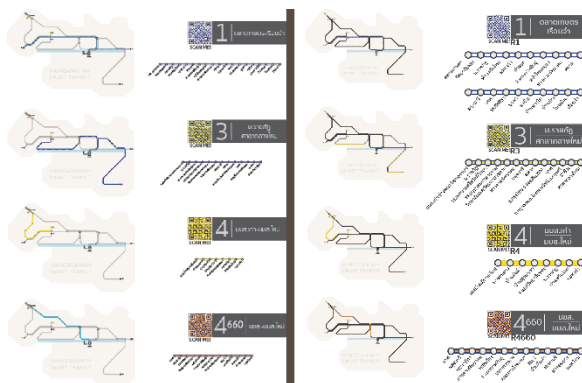


Figure 8. Design Output; Problem 4



Figure 9. Adaptation Map after experts' reviewed.

5. Discussion & Conclusion

After the redesigning at Stage 2, the final product became more complete so this revised graphic map would be used to create a software application. The application would be tried out with the sample group of 100 participants including students, working age, elderly, special participants, and service providers. These participants were the regular customer of

the Song Taew service so their attitude and suggestion would be helpful for a final design of the application.



Figure 10. The Sample of User Interface Design.

This research clearly highlights notable knowledge body from the stakeholders that should be necessary for the development of the mobile application and public transport mapping to serve the travelers in Maha Sarakham province, in which the Human-Centered Design (HCD) theory was also applied to build up a data set on general context of the public transport service in Maha Sarakham. The model application was properly created and modified following the suggestions by the specialists in different associated fields in order to become a smart transit application that work applicably with any other applications.

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Mayor of Maha Sarakham province, Director of Tourism Department, Maha Sarakham, Director of Maha Sarakham Provincial Land Transport Office, the transportation engineering specialists, and the specialists in urban design and culture and art.

7. References

- [1] Siam Business. (2012). *AEC new project "High Speed Train" connect to ASEN*. Retrieved 16 July, 2016, from <http://www.thai-aec.com/642>.
- [2] Ratanachote, T. (2015). Using co-design to express cultural values and create a graphical identity: A case study of Khon Kaen, Thailand. *International Journal of Social Science and Humanity*, 5(10), 832-843.
- [3] Thienmongkol, R., & Thomassen, A. (2013). New 'systems theory': A design configuration of the new transit map for Khon Kaen city. *Journal of Fine and Applied Art*, 5(1), 101-128.
- [4] Nielsen, J. (1993). *Usability engineering*. San Diego: Academic Press, Inc.
- [5] Jokela, T., Iivari, N., Matero, J., & Karukka, M. (2003). The standard of user-centered design and the standard definition of usability: Analyzing ISO13407 against ISO 9241-11. *ACM. Symposium* conducted at the meeting of the The Latin American conference on human-computer interaction New York.
- [6] ISO 13407. (1999). *Human centred design for interactive system*. Geneva: International Organisation for Standardisation.
- [7] Creswell, J. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). New Jersey: Pearson Prentice Hall.
- [8] Jansumbut, C. (2012). *Writing Thesis*. Mahasarakham: Mahasarakham University Press.