Internship Recommendation System Based on Applied Data Mining Techniques

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Abstract

This study aimed to 1) develop 2) evaluate and 3) examine the satisfaction of users of the Area-Based Internship Recommendation System of Applied Data Mining. The system was designed and developed to respond to the comprehensive performances. It was suitable for the abilities of everyone to search for establishments close to the accommodation. provide maps of the company's location and navigate to those locations. Establishments can advertise for interns that meet their needs. The developed system looks like a website, can be accessed through various browsers such as Google Chrome, Mozilla Firefox, and can be displayed on Pcs, smartphones, or tablets. It also had a map to show where individual companies and could navigate the interns to those places. Moreover, it could also advertise the recruitment of internship students in accordance with their requirements through the system. The system was developed a website-based on the Internet. It could be accessed through different browsers, such as Google Chrome and Mozilla Firefox. Its performance

was displayed on PCs, smartphones and tables. The development approach based on the System Development Life Cycle (SDLC), and Apache was chosen as the server emulator for website. PHP was used for programming. MySQL was used for database management. The quality of the developed system was evaluated by 5 computer system experts. The result of evaluation was high ($\bar{x}$ = 4.16, S.D. = 0.62). The satisfaction of the system was evaluated by 30 respondents of the sample group. The result of assessment was high ($\bar{x}$ = 4.21, S.D. = 0.64).

Keywords: Company Recommendation System, Internship, Area-based, Data Mining

1. Introduction

Over the past years the economic development of Thailand has relied more heavily on the enhancement of effectiveness deriving from the labor and natural resource advantages as well as the importation of ready-to-use technologies rather than on the knowledge accumulation. To develop homegrown technologies, the development has to focus on the reinforcement of science and technologies and the increase of abilities to use applied science, technologies and innovations. It would elevate the competitiveness of the manufacturing and service sectors, including people's quality of live (Kanyarat, Chanita, Pornthip and Rattana, 2020). Route Community Tourist Attraction Recommendation System in Ang Thong Province [Online]. 2(1), 1-13.). Also, it could encourage the comprehensive development of innovations and technologies in all aspects – which in turn would lead to an increase in the nation's economic competitiveness, an improvement of people's quality of life, the narrower social gaps, the creation of knowledge and skills which are suitable for all groups of people and the improvement of work performance. Throughout the fiscal year 2021, Digital Economy Promotion Agency or DEPA promoted and supported the general public to have an understanding, basic skills, safe and effective use of digital technologies and information literacy (Chanchai, 2020).

The New Normal caused by the situation of the COVID-19 pandemic has made a number of people change their behaviors together across the world. Instead of being able to go out to workplaces or schools, all types of activities have to be done at home. The business and service sectors also have to change their business operations to keep pace with the current situation, by adjusting themselves to the New Normal to avoid virus contraction, and at same time to revive their economic potentials. This has led to the creation of new innovations and technologies, the adjustment of ideas, perspectives, management approaches, including behaviors in relation to food, clothes, hygiene, education,

communications, and business operations – which were routines previously – to become the New Normal behaviors to which people have gradually become used to and have eventually integrated with their normal way of life (Duangkamol and Rattana, 2021).

For data mining, in the past data was kept in a simple storage system. However, the storage system has been changed to the system of which data is kept in databases. At present, an analysis which relies on a single database can no longer provide sufficient and deep knowledge for the operations in the world in which competitions are rigorous and everything changes rapidly. Therefore, it is necessary to combine various databases together which is called Data Warehouse. It is the method that data from different sources are kept in a common format and in the same storage space (Jeerawut Varin, 2021).

Given the principles and the reasons mentioned above, it is necessary to develop the Area-Based Internship Recommendation System by using data mining to assists the decision-making. Also, the system would allow the companies to recruit internship students in accordance with what they require by putting advertisements on the system. In addition, the students would be able to search the places near to their preferable accommodations and to be offered the internship which suit their aptitudes.

2. Purpose

2.1 To develop the Area-Based Internship Recommendation System by applying data mining technique

2.2 To access the quality of the Area-Based Internship Recommendation System of Applied Data Mining

2.3 To examine the satisfactory of the users of Area-Based Internship ecommendation System of Applied Data Mining

3. Research methods

Scope of the Study

3.1 Population and Sample groups

The population of this study was the companies with which the students of Department of Information Technology and Communications, Bansomdejchaopraya Rajabhat University, had internships. The sample group of this study was comprised of the users of the Area- Based Internship Recommendation System of Applied Data Mining in Bangkok Metropolitan Region (BMR). The 30 respondents were selected by means of the purposive sampling.

3.2 Scope of the developed system

Area- Based Internship Recommendation System of Applied Data Mining defined the access rights and the user rights as follows:

3.2.1 The system was designed to be website-based on the Internet, and could be run on PCs with different browsers, namely Internet Explorer, Google Chrome, and Mozilla Firefox and also on smartphones or tablets.

3.2.2 The usage rights were 1) the system administrator 2) the internship companies and 3) the internship students.

3.2.3 The operation was divided into 3 sub-systems as follows:

A) The membership management system

B) The internship company management system

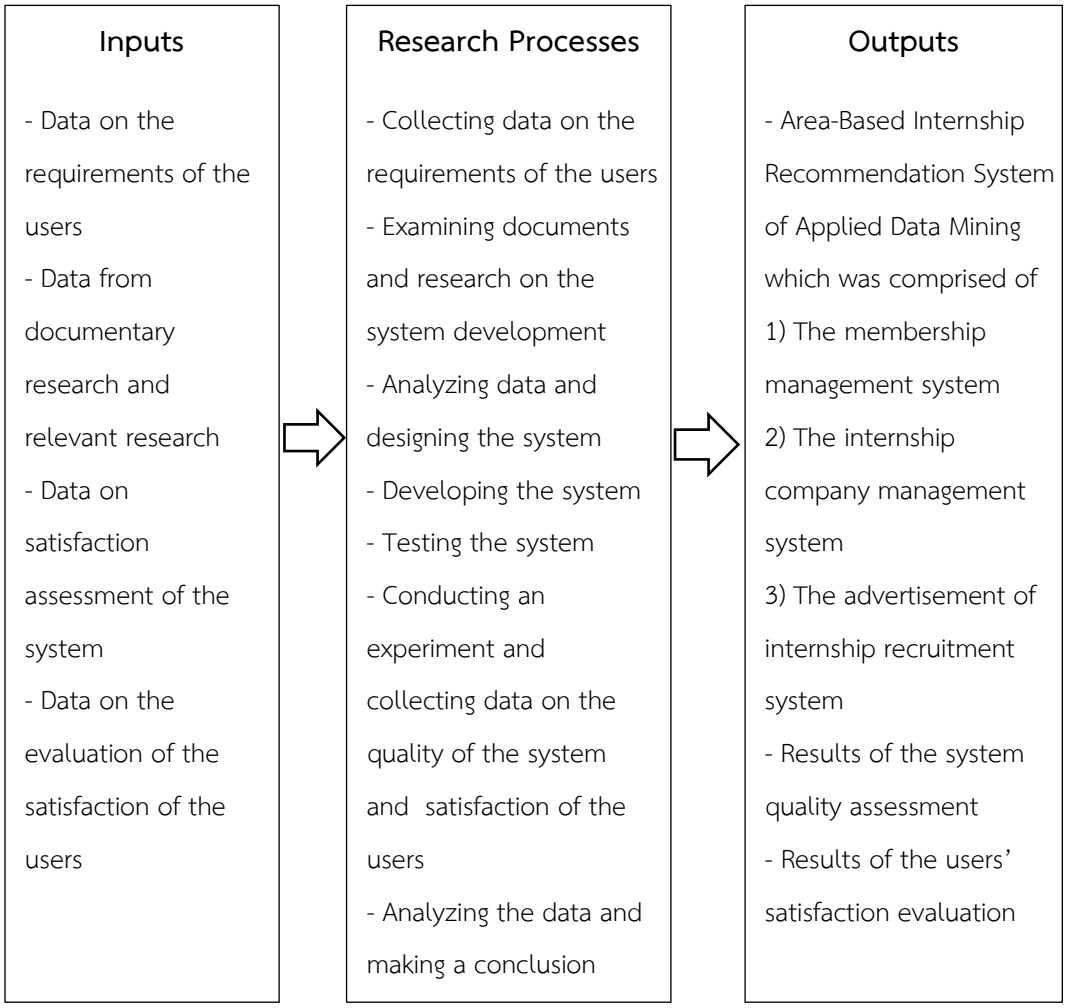
C) The advertisement of internship recruitment system.

3.3 Variables of the study

3. 3. 1 The independent variable was the Area- Based Internship Recommendation System of Applied Data Mining

3.3.2 The dependent variable were the quality of the system and the satisfaction of the users of the Area-Based Internship Recommendation System of Applied Data Mining.

Conceptual Framework



4. Research Methodology

4.1 The collection of data on the requirements of the users was done by interviews with the internship companies and with individuals who wanted to use the system to understand the problems, the requirements, and relevant processes. The data collected from the interviews was used for the implementation and the decision-making relating to the system development. The operation was divided into 3 aspects as follows:

4.1.1 The system administrator could add, delete, edit and search all data about the members, the internship companies and the internship students.

4.1.2 The internship companies could add, delete, edit and search the data about their own companies and the internship recruitment advertisement.

4.1.3 The internship students could add, delete, edit and search the data about themselves and search the internship companies and apply for the internship.

4.2 Study and Research

4.2.1 Data Mining is the process of finding relationships, new patterns and trends by using large amounts of data stored in a data warehouse. Then the mathematical and statistical methods are used to analyze the data. It is widely used in various information systems to increase the efficiency of searching and analyzing data. Data mining technology is used even in supporting systems of decision-making (Phummarin, Kunanya, Piyanan and Prapas, 2021).

4.2.2 Database management systems are software or programs which perform a function of managing databases. They facilitate the users of databases by, for example, creating a database, creating a database storage table and managing databases. The programs come with facilitating tools. The database management programs act as an intermediary between the users of databases and the developed applications to manage data in the databases (Kacha, 2011).

4.2.3 MySQL Database is a Relational Database Management System (RDBMS) program which has been developed by MYSQL AB. It uses SQL as its communication language to be compatible with various operation systems in order to manage data of different systems according to the purposes of program development, for example, PHP and Python. They are suitable for small and large systems (Madyatmadja and Adora, 2019).

4.2.4 System Development Life Cycle (SDLC) has 6 steps as follows: Step 1 problem specification, Step 2 system analysis, Step 3 system design, Step 4

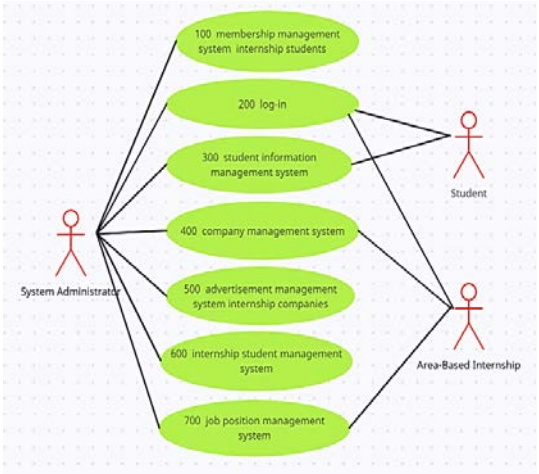
system development, Step 5 system installation and step 6 system maintenance (Ministry of Digital Economy and Society, 2021).

4.3 Making Research Tools

4.3.1 The nature of the job system data and information including the requirements of the relevant users were analyzed. All of them would be used in the system tests to collect data and summarize the results obtained from the system tests.

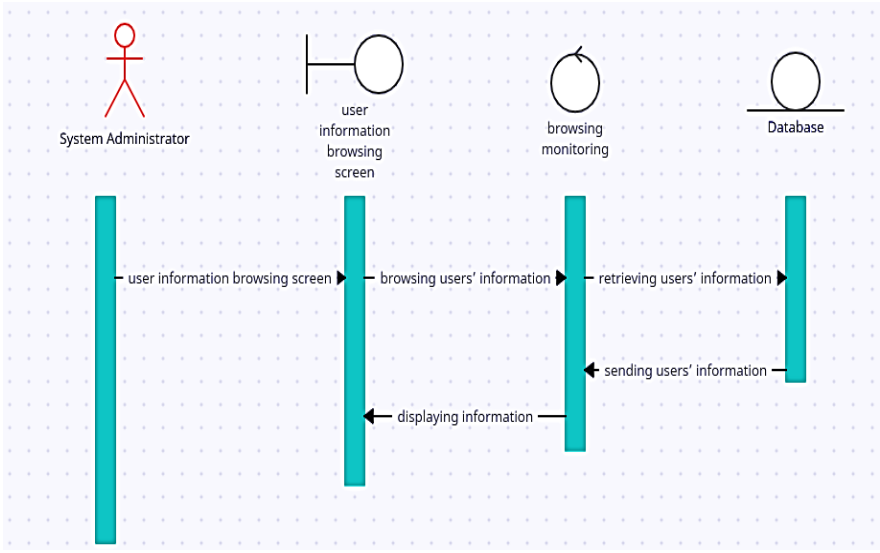
4.3.2 The system analysis: the developers analyzed the systems in the website by using a Use Case Diagram and a Sequence Diagram (Office of the National Economic and Social Development Council, 2021) to describe the systems within Area-Based Internship Recommendation System of Applied Data Mining.

A) The interactivity between the users and the use of Area- Based Internship Recommendation System of Applied Data Mining is shown in Figure 1 and the Sequence Diagram of the user information browsing is shown in Figure 2.



System administrator 100 membership management system internship students
200 log-in
300 student information management system
400 company management system
500 advertisement management system internship companies
600 internship student management system
700 job position management system

Figure 1 Use Case Diagram of the system operation



System administrator/ user information browsing screen /browsing monitoring. system /databases. browsing users' information/ browsing users' information/ retrieving users' information.

sending users' information.

displaying information.

Figure 2 Sequence Diagram of the system operation

4.3.3 System Design: once system requirements of each part had been defined, the screen of the system and databases were designed (Saichon, 2017) with details of individual steps of the operation steps as follows:

A) Web page components could be divided into two parts as follows: 1) the header was the part that consisted of various menus and 2) the content was in the middle of the screen and displayed the main content as shown in Figure 3.

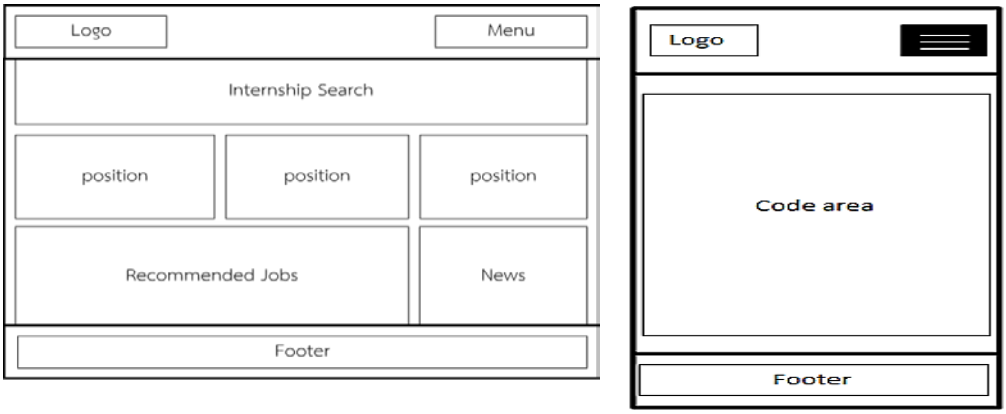


Figure 3 Main page displayed in a normal mode and a Responsive mode.

B) Database design by using an ER-Diagram to show the relationship between entities to make it easier to understand the communications within the system. It consists of 10 tables, namely news table, job table, type table, faculty table, migrations table, organization table, department table, warning table, apprentice table, and user table as shown in Figure 4.

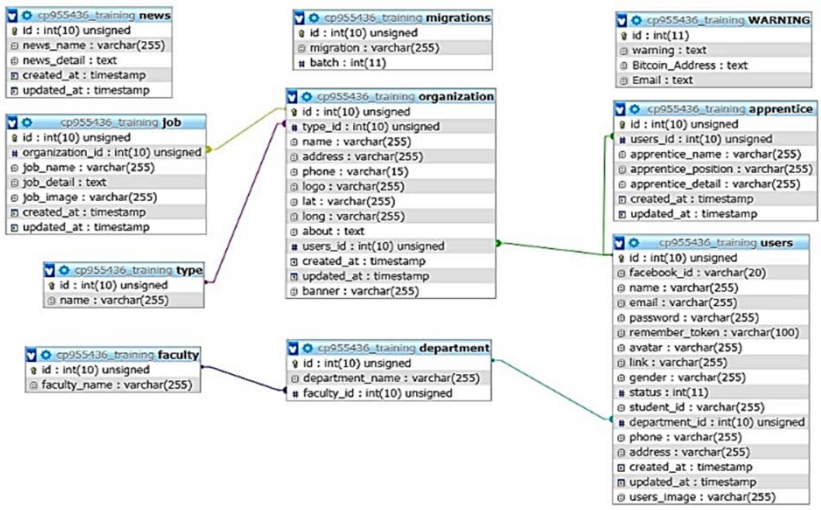


Figure 4 ER-Diagram of the system

4.3.4 The development of the Area-Based Internship Recommendation System of Applied Data Mining: HTML and PHP were used for the development. Sublime Text 3 was used as a program for system development (Thailand Institute of Occupational Safety and Health (Public Organization), 2021) (Thiptida, 2013). MySQL was used to create database management system.

4.3.5 System test: After the development of the system had been completed successfully, the next step was a system test. The researchers would test to find errors, adjusted, and then corrected any errors which were found. This would allow the system to operate more accurately and efficiently to respond to the users as much as possible. The test was specified and implemented according to the test plan (Test Case) for checking system errors.

5. Results

5.1 The result of the development of the Area-Based Internship Recommendation System of Applied Data Mining in this study: the researchers

developed the usage system on Chrome browser, which could be displayed in two modes, namely a normal display and a responsive display as follows:

5.1.1 Main page: It is the first page of the website. It consisted of different menu bars and a log-in. It was displayed in a normal mode and a Responsive mode. It was divided into 4 parts, namely 1) internship company search 2) internship company display 3) a listing of recommendation displays 4) public relations display. They are shown in Figure 5.

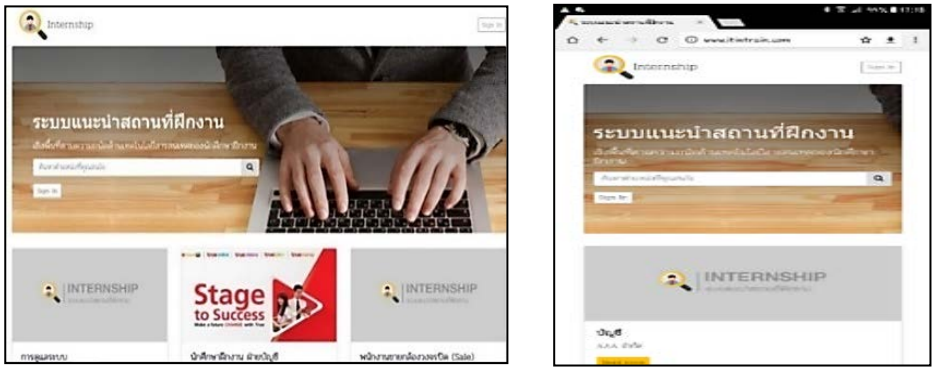


Figure 5 Main page displayed in a normal mode and a Responsive mode

5.1.2 Log-in the Area-Based Internship Recommendation System of Applied Data Mining: It consisted of types of log-in as follows: 1) Log-in with Username of the internship search system 2) Log-in with Username of Facebook. They are shown in Figure 6.

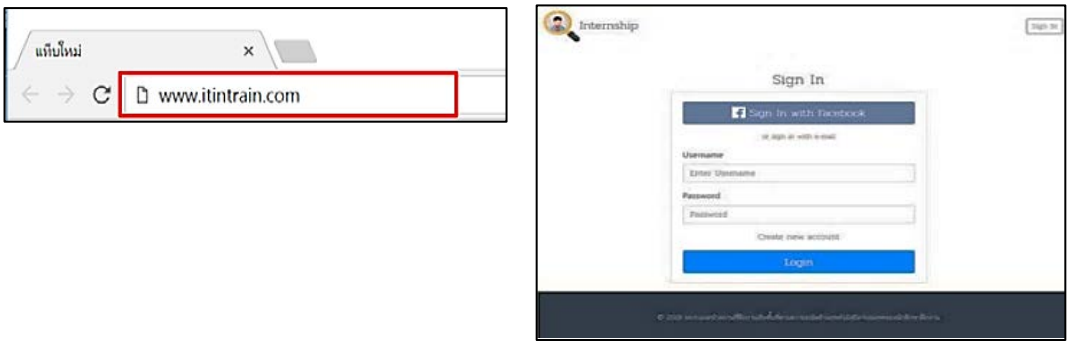


Figure 6 Log-in the system with Username

5.1.3 System administrator section: It dealt with the management of internal system, such as membership management system, student information management system, internship companies management system, management system. It is shown in Figure 7.

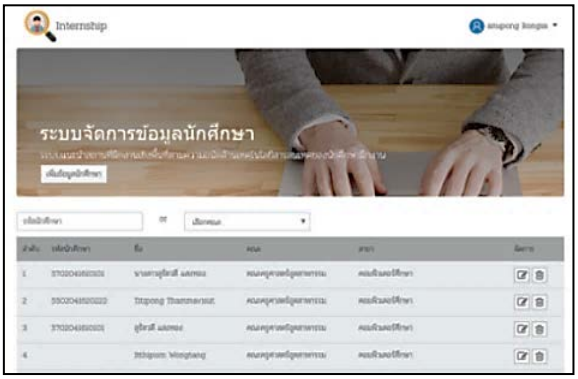


Figure 7 Student Information Management section in a normal display

5.1.4 Student Section: It was the part for editing personal information in the student information management system and the part of internship company search. It is shown in Figure 8.

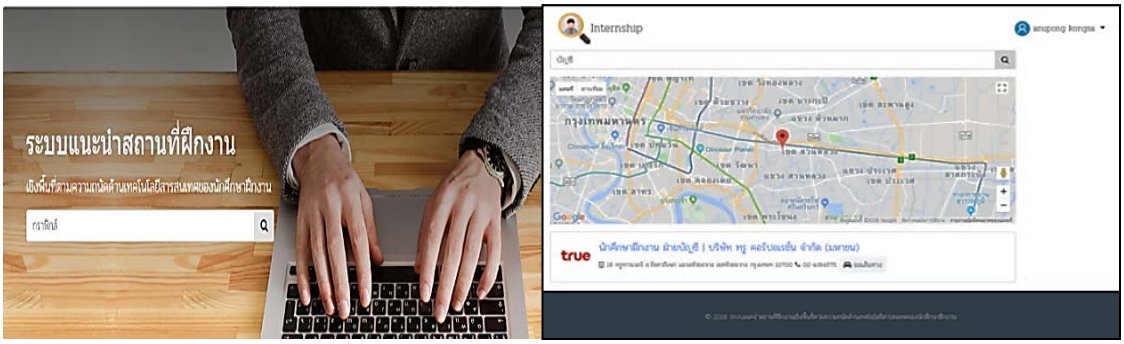


Figure 8 Internship company search and location of the company section

5.1.5 Internship Company Section: It was the part which dealt with registration and the editing of information of the companies in the internship company management system. They are shown in Figure 9 and Figure 10 respectively.

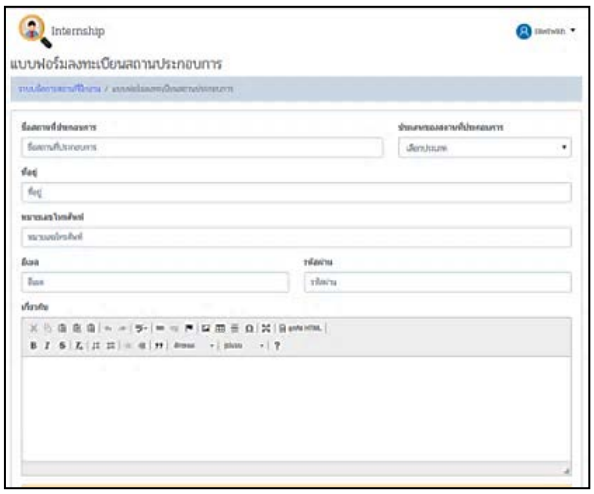


Figure 9 Internship company registration section

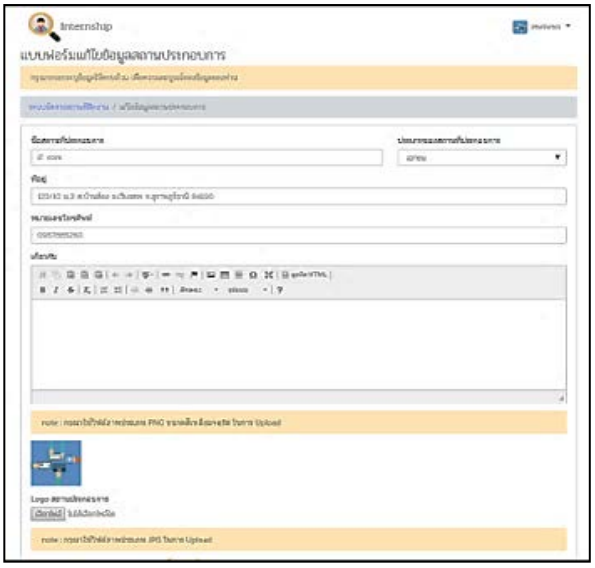


Figure 10 Internship company information editing section

5. 2 The result of the quality assessment of the Area- Based Internship Recommendation System of Applied Data Mining by 5 computer system experts is shown in Table 1.

Table 1 The Quality Assessment of the Area-Based Internship Recommendation System of Applied Data Mining

Assessment Items	Quality Level		
	$\bar{X}$	S.D.	Meaning
1. Suitability of functionality the program	4.20	0.45	High
2. Accuracy of the performance of the program	4.00	0.71	High
3. Convenient and easy to use	4.40	0.55	High
4. Speed of the performance	4.00	0.71	High
5. Data protection and safety	4.20	0.84	High
Total	**4.16**	**0.62**	**High**

According to Table 1 which shows the quality of 5 different aspects of the program assessed by 5 computer experts, the overall quality was high ($\bar{X}$= 4.16, S.D. = 0.62).

5.3 For the result of the Area-Based Internship Recommendation System of Applied Data Mining user satisfaction assessment, the researchers had tested the completeness and the accuracy of the system, and then asked to users to use the developed system. This was for the examination of the satisfaction of 30 the internship companies. It is shown in Table 2

Table 2 The Examination of the User Satisfaction in all Aspects

Assessment Items	Quality Level		
	$\bar{X}$	S.D.	Meaning
1. Usage convenience	4.33	0.71	High
2. Processing with a satisfactory speed	4.27	0.70	High
3. Accuracy of the information retrieval and display	4.13	0.74	High
4. Simple operation process	4.07	0.68	High
5. Easy-to-understand system	4.27	0.64	High
Total	**4.21**	**0.64**	**High**

As can be seen in Table 2 which show the user satisfaction of the system in all aspects, the level of the user satisfaction was high. ($\overline{X}$= 4.21, S.D. = 0.64)

6. Discussion and Conclusion

This study aimed to develop the Area-Based Internship Recommendation System of Applied Data Mining. The assessment tools were the quality assessment form and the user satisfaction evaluation form. The discussion and the conclusion of this study are as follows:

6.1 The Area-Based Internship Recommendation System of Applied Data Mining was a website-based. It could be run on various browsers on PCs, smartphones, and tablets. The usage rights were divided into 3 rights for 3 types of users, namely a system administrator, internship companies and internship students. The operation was divided into 3 systems, i.e., the membership management system, the internship company management system and the system dealing with advertisement of internship recruitment according to the requirements of the companies. The researchers analyzed and designed the system in accordance with the theory of analysis, design of an object-oriented system with UML (Unified Modeling Language) and developed the system in accordance with the theory of System Development Life Cycle which are as follows: 1) problem specification 2) analysis 3) design 4) development 5) testing 6) installation and operation and 7) maintenance. This would make the development of the system more efficient and could meet the requirements of the users. It is in line with the study conducted by Duangkamol Phonak and Rattana Leerungnavara (Duangkamol and Rattana, 2021) who examined and developed a doctor appointment and medicine alert system on Android. The development of this system adopted the approach which began with the specification of the problems pertinent to the system development, and then the analysis of system requirements and the system design, all of which were used to develop

the system. The system underwent a testing process. After the completion, the system was put in a practical test. The last step was the maintenance of the system, making it ready for usage.

6. 2 The quality assessment of the Area- Based Internship Recommendation System of Applied Data Mining by 5 computer system experts was highest ($\bar{X}$= 4.73, S.D. = 0.44) overall. It is consistent with the study of 14. Kanyarat Aliwongsakun et al. (Kanyarat, Chanita, Pornthip and Rattana, 2021). They developed an online system to recommend routes to community tourist attractions in Ang Thong Province. It was found that the tourist route guidance system could suggest information about the places along the route by making an ascending rank of tourist attractions in accordance to the distance between the places and the users, ranking the closest location on the top. It could assist the users to select the desirable tourist attractions from the recommended information. The quality of the system was by computer system experts. Its overall assessment result was high ($\bar{X}$= 3.54 S.D. = 0.55).

6.3 According to the result of the examination of the user satisfaction, it was found that the satisfaction was highest ($\bar{X}$= 4.77, S.D. = 0.46). It shows that the developed system can respond to the comprehensive usage of the users. It can be used to find internship places which are suitable for students' aptitudes. It also has a map which can show the quick and easy routes to the locations of internship companies. It is in line with the study of Phummarin Hrangnoi et al. (Phummarin, Kunanya, Piyanan and Prapas, 2021). who conducted research on the application of data mining technique to IT careers recommendation system for undergraduate students, the case study of Rajamangala University of Technology Thanyaburi. The results of the quality and the satisfaction of the system were good with an average score of 4.27.

7. Recommendations

7.1 There should be the development of automatic feedback and notifications of internship.

7.2There should be the development of the system which can disseminate public relations and news in relation to the internship through various channels both directly and online from the system to make the students be informed comprehensively.

7.3 The search results on the map should display other types of information, such as accommodation information and facilities. It would help the students to decide on their internship opportunities.

7.4 There should be a support system for the internship companies. Able to request to accept students for vocational internship.

7.5 The findings can be adopted as a prototype for developing curricula that incorporate professional internship

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