Travel Information System on Intercity Motorway

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Abstract— This research proposed the Motorway Travel Information system (MTIS) to assists motorists in using the motorway. The system architecture supports both context-aware information for alert and warning, and a new approach is used to provide motorists with information about the businesses at each of the exits. Each business at an exit must be registered with the NTIS service server in a computing cloud. Algorithm is designed to exploit this information. Consequently, the passengers in a car can make requests to the servers to find matching services by business entities located at an exit. Several heuristics are proposed to use in the matching algorithm to find the desired exits to get the services requested by the passengers.

Keywords- Intercity motorway; travel information system; context aware.

I. INTRODUCTION

After the initial Department of Motorway Master Plan in 1997, the latest review of the new master plan intends to match the current highway system in accordance with the national infrastructure development strategy to provide access to economic resources, tourist attractions, border trade, and special economic zones. In support to the ASEAN Economic Community (AEC) \ Framework, the plan will be developed for 20 years from 2560 to 2579 with a division into two-time segments from 2560 to 2269 during the first 10 years and then the next 10 years starting in 2570. – 2579. The route line has a total of 21 routes, a total of 6,278 kilometers which is more than the original master plan which was more than 2,100 kilometers with 13 networks for a total distance of 4,150 kilometers

Traveling on the highway between cities there are a limited number of service points called rest areas. Additionally, on the highway between cities, there will be an emergency points with a phone periodically placed, and there will be a CCTV camera installed periodically as well.

The highway route between cities is a route with toll gates that provides a way for cars and trucks to pass through to pay cash or use electronic cards as a fee for using the highway. In driving on these highways, normally drivers will know where they are going. But knowledge regarding the highway and the exits is not always very clear.

II. TECHNOLOGY USED FOR SPECIAL HIGHWAYS BETWEEN CITIES

Current technology system provides services and are in accordance with the international standards of special highways between cities. The Special Highway Division between cities Department of Highways has provided various systems to support traffic management and provide services to users with the following system details in the Figure 1.

- Optical fiber network system
- Wireless network media system (Wireless)
- Leased line network system and internet connection (Leased Line and Internet Connection)
- Radio communication system
- Network management system
- Systems installed for internal use
- Traffic Management System

III. SYSTEMS INSTALLED FOR INTERNAL USE

A. GPS system

GPS system is to track all rescue vehicles running on the route to service all vehicles. The GPS system is used to track if an incident requires a rescue vehicle to check or proceed. The control center will be able to check the location of all rescue vehicles and will be direct them through a radio communication system to allow the nearest rescue vehicle to proceed.

The tracking system of the Special Highway Division between cities has the following capabilities:

1. Real-time tracking. You can view the current location of the car and show the location details.
2. Viewing historical data to know the past journey Either of the current day, the previous day or the previous month Can show the route backward
3. Daily activity summary report shows car usage information, travel distance, over speed, total transportation time, and time for parking
4. Speed (Speed Report) rendering speeds using the graph reports. In addition to the above reports, there are also useful reports such as daily activity details reports, stop / park report, alarm report, fuel consumption report, and over speed report.

B. Rescue Management System (IMS)

The Rescue Management System (IMS) will have the staff of the control center and will be the key unit for information related to rescue work.

Accident clock system is a system developed for processing and collecting statistical data from important events and accidents data. Everything that happens in all directions will be displayed as the number of events that occur on a motorway point. This information can be used to develop and improve user safety. If any area has information on events or repeated accidents, it means that the area is not safe. The relevant units will be notified to check and make corrections in order to reduce the amount of problems in that spot.

C. Social Media System

Social media system (Social Media) that is used includes website http://www.motorway.go.th, Facebook fan page system, and notification system via Line program. Fanpage Motorway news room, founded on January 10, 2013, aimed to provide people access to information - such as traffic data information, accidents, and delays that are occurring on the motorway route.

However, the information systems to provide travel information for motorists to find the destination, to request certain services or to identify the exit that will lead to the destination is not readily available through the motorist's mobile phone. There is area of travel information system on highway or motorway is a topic that attract interest of researchers.

IV. PROBLEMS THAT LEAD TO RESEARCH

After entering the motorway, drivers will drive on the route without clear information regarding exit points. As a result, drivers do not know what services are available to them and which exits provide the services. Another problem is that when leaving the motorway at the exit point, sometime returning to the entry point is a problem. There are exits that do not have entry spots on the motorway, so knowing clearly where the re-entry point is important.

A. Intercity Motorway Model

Let us assume that there are N entrances and there are M exits on the route going out from one city to other cities. The U -turn from one route to the other can be a horseshoe U-turn or a U-turn realized by exiting the intercity motorway and then finding the nearest entrance to the motorway in the opposite route to re-enter the motorway. In development the application of supporting travel information system on Intercity Motorway, the infrastructure comprises of the internet, cloud servers, mobile applications as depicted in Figure 2.

To assist motorists, the MTIS control algorithm is used to identify the needed services at the exits ahead of the motorists. Three algorithms are proposed in [1]. The algorithms will identify the next exits that will find the requested services by the motorists in a car moving forward on the intercity motorway.

(1) The First Come First Serve Heuristics.

(2) The Shortest Service Time First.

(3) The Total Shortest Service Time.

The details of these algorithms can be found in [1]

B. Research problems

In order to support travel and tourism using Motorway, it is important to study and analyze the travel information system on intercity motorway.

1. Give information about what to see and where to go.

2. Provide accommodation information such as rest areas.

3. Provide information about road conditions ahead.

4. Provide entry points to motorway.

5. Give advice which exit point to exit in order to find the desired services

6. In research and development, MTIS will apply mobile device technology, GPS, digital compass, content-aware computing, and cloud servers to design the MTIS system.

C. Methodology

The focus is on the design of the Travel Information System on Intercity Motorway or TISIM which will take Context-aware Technology and Augmented Reality on Geo Grid to create a new innovation that benefits the public.

Tools used include the following:

- Questionnaire
- In-depth interviews
- Data collection of operational levels related to the operation of special highways between cities in data
- Data collection, evaluation of satisfaction of the system using TISIM

The questionnaire was divided into 4 parts as follows:

Part 1: An opinion from the game related to the ivory box made of TISIM affecting the glistening unhappy message to travelers.

Part 2: Comments About the services of TISIM

- In terms of ease of use
- In the main data
- In support of information

Part 3: Open-ended questionnaires about suggestions

Part 4: A questionnaire to evaluate satisfaction TISIM.

In-depth interviews were conducted by contacting Manager level or person Commander of the agency that operates the special highway between cities regarding issues related to TISIM

D. Data analysis

The questionnaire part 1, part 2, and part 3 will be made on a scale of 5 levels, according to the measure of Likert's Scale, which provides criteria to assess the level of opinion toward the SSS and comments concerning TISIM services.

In evaluating the MTIS, a basic version of MTIS was developed and questionnaires were developed to solicit the opinions of sample users based on a mix-method design. Quantitative data from a questionnaire and qualitative data from in-depth-interviews were used for assessing the effectiveness of the new MTIS system. The population in this study was officers of Benchmark Vision who were consultant to Intercity Motorway for developing the Intercity Motorway Technology Plan. In this case, the sample size in this study was 30 respondents. This group was selected for their knowledge and understanding of the intercity motorway which are directly related the use of MTIS. The instrument for data elicitation in this study was a questionnaire- namely, The MTIS Questionnaire. The quantitative data from the questionnaire was analyzed by descriptive statistics, and the qualitative data from the interview were qualitatively analyzed and presented.

E. General Information of Respondents

The demographic data of the respondents were summarized as follows. Most of the respondents of the questionnaire (66.00%) were male, while the rest (34.00%) were female. The ages of the respondents were ranked from the highest to the lowest as follows: 21-40 years old (83%), 41-60 years old (17%), more than 60 years old (0.0%), and less than 21 years old (0 %) respectively. The levels of education of the respondents were ranked from the highest to the lowest as follows: beyond bachelor degree or equivalent (33%), and bachelor's degree or equivalent (50%) respectively, which indicated that the majority of the respondents (17%) were highly educated

TABLE I. OPINIONS OF THE IMPLEMENTATION OF MTIS

MTIS	**Levels of Opinions**				
	5	**4**	**3**	**2**	**1**
1. The MTIS services provided through mobile devices are more convenient and give more satisfaction to a user.	80%	20%	0%	0%	0%
2. MTIS is a new service that expand the effective motorist space to cover, not only space on the motorway, but the business entities on the Exits, that are registered with the MTIS Service Server. So, the motorist can request to find the desired service on an EXIT.	83%	17%	0%	0%	0%
3. Any specific interest of the motorist to find the desired service can be answered or assisted by the MTIS Service Server.	80%	20%	0%	0%	0%
4. The MTIS can be developed to add Augmented Reality to help identify the business entity over the eye of sight when scanning on the motorway to find the business entity beyond the boundary of the motorway.	92%	8%	0%	0%	0%
5. The extra revenue of business entity can be monetized by providing services to the motorists. Hence, the MTIS can contribute to the local economy	96%	4%	0%	0%	0%
6. The context aware component can alert the motorist to find the desired services at lunch time and dinner time. The type of services is context-aware.	95%	5%	0%	0%	0%
7. The context-aware of an accident on the motorway and making recommendation of actions is very helpful.	96%	4%	0%	0%	0%
8. Do you enjoy travelling on motorway?	100 %	0%	0%	0%	0%
9. Do you think e-commerce service should be provided to the motorists?	60%	24%	16%	0%	0%

10. The next u-turn function is quite useful to help motorists travel in the opposite direction on motorway.	95%	5%	0%	0%	0%

Table 1 shows the opinions of MTIS operation factors and the success of providing the services to motorists. The respondents' opinions concerning all questions clustered around strongly agree and agree with the propositions. Only the opinion about providing the e-commerce services were ranked agree 24%, strongly agree 60% and neutral 16% which indicates that the offering of e-commerce function during the trip may not as desirably function as other functions. But this is also debatable since many exits of motorway spanning northeastern and northern provinces might have OTOP shops selling local handicrafts and local food that motorists might want to buy as souvenir.

V. CONCLUSION

Motorway Travel Information System is a valuable system for motorist travelling on intercity motorway. With the expansion of motorway to regional cities, more motorists will be on the road. This study will provide an insight to know how to structure the services that the motorists will deem appropriate and hence will use those function regularly making the future MTIS a successful system. The context awareness built into the MTIS would provide some rudimentary intelligence to the system. The current implementation as reported in [1] is based on the recommendation system of MTIS in which all business entities located near the exits will be registered with service profiles that the requested services can be identified and ranked according to the specified criteria, and the motorists inside the car can have the requested services. The future implementation, deep learning or AI can be introduced to provide advanced conversational intelligence to the motorist so that motorist can identify and obtain the needed assistance easily.

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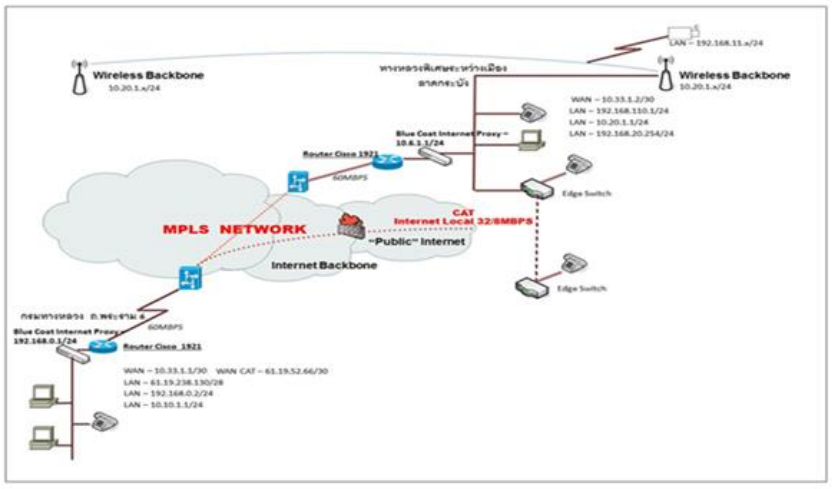

Figure 1. Architecture of the main network

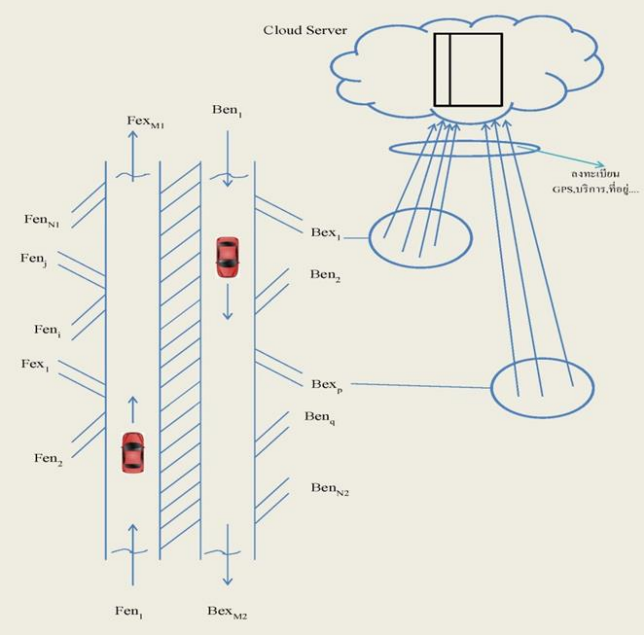

Figure 2. A model of the intercity motorway showing the entrance points, and exit points.
The information of each of these points consists of name, GPS location. The horse-shoe U-turn, and the exit-entrance U-turn [1]