Enhancing Mobile Risk Area Notifications via Social Media Data: A Case Study of Three Southern Border Provinces in Thailand

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Abstract— This paper introduces a mobile-based risk area notification system for the three provinces in the southern border region of Thailand utilizing the collected social-media dataset. The application serves as a platform for providing information on incidents occurring in the southern border provinces, allowing users to safely travel and carry out daily activities in these high-risk areas. The objectives of this paper are twofold: (1) to develop a risk area notification system on mobile for the three provinces in the southern border region, using a rule-based algorithm. The system will notify users of risk area information based on data collected from various sources, including databases and online social platforms and (2) develop a social media data collection approach for a mobile-based risk area notification system. The structure of the risk area notification system on mobile includes three main menus: (1) Login, (2) Register, and (3) Information. After logging in, users can choose from two working modes: (1) basic mode, where the system retrieves risk area data based on incident data in a database, and (2) AI mode, where the system retrieves data both from the database and a collected social-media dataset. Google API is used to detect the user's location through mobile devices and create a customizable route including the incident information for users. After completing the program development phase, an evaluation phase was conducted through questionnaires from experts and general users, resulting in an average score and standard deviation of 4.31 (SD=0.59) and 4.36 (SD=0.58), respectively. From the evaluation results, it can be concluded that the mobile-based risk area notification system for the three provinces in the southern border region, demonstrates good efficiency.

Keywords- *Alert System, Social media, Artificial Intelligence, Mobile application, Risk area.*

I. INTRODUCTION

From 2004 until the present time, the security issue in the three southern border provinces has been considered of extreme importance for Thailand. The ongoing conflict in the region has resulted in a significant number of fatalities [1]. From an outsider's perspective, the southern border provinces are viewed as high-risk and dangerous areas. However, due to varying circumstances, some individuals from outside the region still need to travel within these areas, whether for work, tourism, or as a transit route to their final destinations. Naturally, travelers venturing into the southern border provinces feel fear and a lack of safety. Ideally, it is crucial for them to access information about past and current conflict incidents in the area, which is essential in making informed decisions to avoid potential risks.

The broadcasting of news and information regarding the unrest in the three southern border provinces is varied, ranging from television reports to various online social media platforms [2]. However, the completeness and adequacy of such information are insufficient for travelers or residents in the area to utilize effectively, especially

when attempting to check multiple sources simultaneously and in real-time [3].

In the present day, mobile phones and mobile applications have become integral parts of the daily lives of numerous people, primarily due to their increased affordability compared to the past. The integration of computer technologies into mobile devices, such as location-based applications and emergency alert systems, has further improved their efficiency. Additionally, advanced computer learning techniques and artificial intelligence have been applied in current applications to enhance productivity significantly [4].

The objective of this paper is twofold: (1) to develop a mobile alert system for high-risk areas in the southern border provinces. The system will provide risk information based on data from multiple sources, including databases and online social media (2) to develop a social-media data collection approach for a mobile-based risk area notification system.

II. LITERATURE REVIEW AND RELATED WORKS

A. *Situation in Thailand's Three Southern Border Provinces*

The unrest situation in Thailand's three southern border provinces primarily refers to the ongoing conflicts, especially in the southern region of Thailand, particularly in the provinces of Pattani, Yala, and Narathiwat. There have been some incidents spreading to certain districts of Songkhla province as well.

Initially, the region mentioned above was the independent Sultanate of Patani until cultural assimilation led to conflicts starting around 1948. This led to the ethnic and religious division in the Malay Muslim-majority provinces. The violence has escalated with several incidents of low-level territorial separatism over the past decades. However, the situation worsened in 2001 and again in 2004, during which, from 2004 to 2011, there were approximately 4,500 fatalities and 9,000 injured. The attacks became more indiscriminate and increased in intensity.

Between 2004 and 2011, more than 4,500 people lost their lives, and over 9,000 were injured due to the unrest, making it the deadliest conflict in Southeast Asia. In 2011, the situation shifted to a low-intensity conflict, with most incidents being shootings, but there were still around 12 bombing incidents per month. There were more than 11,000 violent incidents and over 2,000 bombings.

According to data from the Southern Border Provinces Administrative Centre (SBPAC), the frequency of incidents fluctuated, with the highest number in 2007 with 2,409 incidents, and in 2012 with 1,851 incidents. SBPAC noticed that the frequency of incidents may follow a cyclical pattern with the highest frequency occurring every five years. The number of deaths per year has been decreasing since 2013. The main targets of attacks were security forces, government officials, schools, and temples, with over 90% of the fatalities being civilians in 2018. By 2018, the attacks on security forces decreased to 1-2 incidents per month. The commonly used tactics included roadside bombings and shootings, utilizing pipe bombs, M79 grenade launchers, and M16 assault rifles [1].

B. *Related Works*

In this paper, we reviewed the literature and divided it into two groups: (1) survey research in the three southern border provinces, and (2) information systems or applications for various notifications. The details of each document are as follows:

In [5], the authors focused on studying the roles and duties of personnel in the Personnel Development Office, who work in the Southern Border Provinces Administrative Center to resolve issues of instability in the southern border provinces. Two roles were studied: the role of mass psychology operations and the role of coordinators in resolving problems of unrest in the area.

In [6], shows the study of the impact of instability events in the three southern border provinces: A case study of Chalerm Subdistrict, Rangae District, Narathiwat Province. This research focused on studying the situation of the impact of instability events in the three southern border provinces, using qualitative research methods such as in-depth interviews and group discussions. The information was gathered from 35 relevant individuals, including community leaders and youth in Chalerm Subdistrict, Rangae District, Narathiwat Province. The findings revealed that the influential group showed interest in issues and unrest events. The involvement of Muslim youth in the instability events was significant due to their limited qualifications, making them susceptible to being influenced by violent groups. The solution to this problem lies in instilling stability and common consciousness among the people to not fall for the instigation of these unruly groups.

As for research related to information systems for various notifications or notification applications, the following are the details:

The application of geographic information systems to assess landslide-prone areas in Phu-Luang, Nakhon Si Thammarat Province was proposed in [7]. This study aimed to determine landslide-prone areas and create maps to manage geographic information by using ArcGIS 9.2. The study involved seven factors, including rainfall, past occurrences, terrain height, terrain slope, waterways, and land use, with each factor weighted and ranked according to its importance in causing landslides.

In [8], the development of disaster notification applications for Thai society was proposed. This research focused on developing an application for notifying various emergencies, such as natural disasters, accidents, conflicts, or robberies, through smartphones or tablets. The application sends relevant data, including still and moving images and coordinates of the reported incidents, to the responsible agencies promptly. The application also informs the users about the emergency's location and the responsible agency.

A system for monitoring and warning of flash floods was proposed in [9]. This system serves as a tool for the general public, students, local government agencies, and community networks to warn against flash floods in risk-prone areas of Chiang Klang District, Nan Province. The system collects daily rainfall data, which is available from volunteers' disaster warning meters or from the Department of Meteorology's stations in Chiang Klang District, and processes this data into additional information for the system to enhance the efficiency of the warning process.

Warning of flood hazards using Artificial Intelligence and social media was proposed in [10]. This system collects and processes flood-related data from Twitter to provide warnings to people at risk. The system employs artificial intelligence and social media to collect information from the general public during a flood event. The researchers analyze and add the data to the system to enhance the efficiency of the warning process. The system has the capability to predict and warn about flood events, making it a valuable tool for people in the southern border provinces who want to prevent themselves from dangerous situations. The system's warning is based on both rule-based and AI-based principles.

The development of a mobile-based warning system for risk areas in the southern border provinces was proposed in this paper. Our system will incorporate and provide information gathered from multiple sources, such as databases and online social media. Additionally, we also proposed a social-media data collection approach for a risk area notification system on mobile for three southern border provinces in Thailand which users can benefit from to protect themselves from dangerous situations.

III. System Analysis and Design

A. System Analysis and Design for a Risk Area Notification System on Mobile for Three Southern Border Provinces in Thailand

The use case diagram is a visual representation that illustrates the system's functionalities and what it can do. It shows the relationships between the system's users and various functions within the system. In Figure 1, the use case diagram of a risk area notification system on mobile for three southern border provinces in Thailand was illustrated. The system's user can perform the following actions:

1) Register: users can sign up and create an account in the system.
2) Login: users can log in to their accounts.
3) Manage Data: users can manage their account information.
4) Locate Position: users can specify the source and destination locations.
5) View Information: users can view details of various risk events.

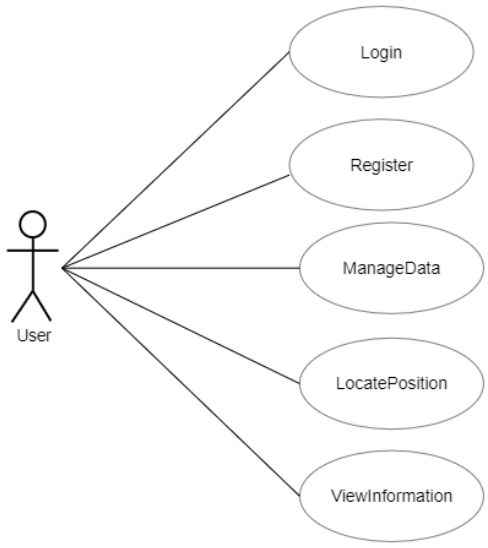

Figure 1 Use Case Diagram of the Risk Area Notification System on Mobile for Three Southern Border Provinces in Thailand

Moreover, we have designed the following steps for the notification process:

1) The system retrieves the user's current location data through GPS.
2) It compares the user's current location with the locations of various incidents stored in the database.
3) If the distance between the user's current location and the incident locations in the database is within 15 kilometers, the system displays incident information, including the incident name and its severity level, on the map.
4) The system gets data from a social media dataset for verification and notification purposes.
5) If the distance between the user's current location and the incident locations in the database is

within 15 kilometers, the system displays the notification information.

6) The user's current location is updated every 10 minutes.
7) All steps are repeated until the user reaches their destination.

B. A Social-media data collection approach for a Risk Area Notification System on Mobile for Three Southern Border Provinces in Thailand.

Pseudocode: RAAS-media-collection

```
START
    SET keyword_for_query
    SET geo_code //latitude, longitude, radius of this location
    SET max_records //The maximum number of query records
    FOREACH keyword ∈ keyword_for_query
        call tweepy library
        FOREACH record ∈ tweet_list
            call preprocessor library for clean the text
            call sentiment function of TextBlob library

            to get the polarity and subjectivity score of NLP
            Save to file

        END-FOREACH
    END-FOREACH
STOP
```

Figure 2 Illustrates the pseudocode of a social-media data collection approach for a risk area notification system on Mobile for Three Southern Border Provinces in Thailand.

This section proposed the social-media data collection approach for a risk area notification system on mobile for three southern border provinces in Thailand. There are several steps as follows:

1) Set keywords for querying such as roadside bombings and shootings, utilizing pipe bombs, M79 grenade launchers, and M16 assault rifles.
2) Set a geographic code using the latitude, longitude, and radius of this location.
3) Set maximum records for our dataset. In our case, we used 300 as the maximum number of query records.
4) For each keyword is a subset of keywords for query, repeat call a tweepy library.
5) For each record is a subset of tweet lists, call the library to clean the text. Then, call the sentiment function of the TextBlob library to get the polarity and subjectivity score of Natural Language Processing.
6) After that, save all 18 attributes to the file.
7) Then repeat the process until the criteria are satisfied.

There are 18 attributes collected from tweeter posts such as tweet id, original text, clean text, sentiment and polarity value, hashtags, and location.

The proposed RAAS social media data collection approach shows in Figure 2 and all 18 attributes obtained from the social media data collection approach shows in Table 1.

Table 1 Shows all 18 attributes obtained from our social-media data collection approach.

Attributes	Attribute details
id	request tweet ID
created_at	Date/time of post tweet
source	Tweet devices such as web, iphone
original_text	Text in tweet
clean_text	Cleaned text from tweet
sentiment	Polarity and Subjectivity
polarity	Polarity value [-1,1]
subjectivity	Subjectivity value [0,1]
favorite_count	Total number of Like from other twitter
retweet_count	Total number of retweet from other twitter
original_author	Username of post tweet
hashtags	Hashtag of this tweet
user_mentions	Username of other twitter who comment this post
place	Place
geo	Longitude and latitude from device's location
coordinates	Coordinates of tweet user
location	Location
lang	Post Language

IV. RESULTS

A. System Structure

The developed system for mobile risk area notification for the three southern border provinces is presented in the main interface, as shown in Figure 3. In this user interface, users can choose from three menus: (1) "Login" this menu allows users to log into the system (indicated by arrow number 1), (2) "Register" this menu enables users to register by providing their information, including name, email, and password (indicated by arrow number 2), and (3) "Information" menu which provides a general information about the program (indicated by arrow number 3).

Figure 3 illustrates the main screen of the mobile risk area notification system for the three southern border provinces in Thailand. After selecting the "Register" menu, the system displays a registration information input screen. Once registration is completed, the system presents a menu to choose the working mode of the mobile risk area notification system. If the user has already registered and wants to log in again, they can choose the "Login" menu,

which prompts the system to display a login information input screen.

Figure 3 Illustrates the main screen of the Risk Area Notification System for the three southern border provinces in Thailand.

The "Locate Destination" screen allows users to specify their desired destination by entering the name of the province, district, and sub-district. Afterward, the Google API detects the user's location through their mobile device and generates route options for the user to choose from. The system then locks the chosen route to retrieve information from the database regarding the security situation. In the case of selecting the AI mode, the system will notify users of risk area information based on data collected from various sources, including databases and social media datasets.

After choosing the working mode in Figure 4, the system displays the screen to input destination information, then the system shows the list of incident notifications as shown in Figure 5.

B. System Evaluation: Mobile Risk Area Notification System for the Three Southern Border Province

System Evaluation was conducted by both computer and information technology experts (5 experts) and general users (30 users) for example tourists and civilians who travel to the three southern border provinces. The evaluation covered two aspects:

First, the evaluation of the capability of the mobile risk area notification system for the three southern border provinces.

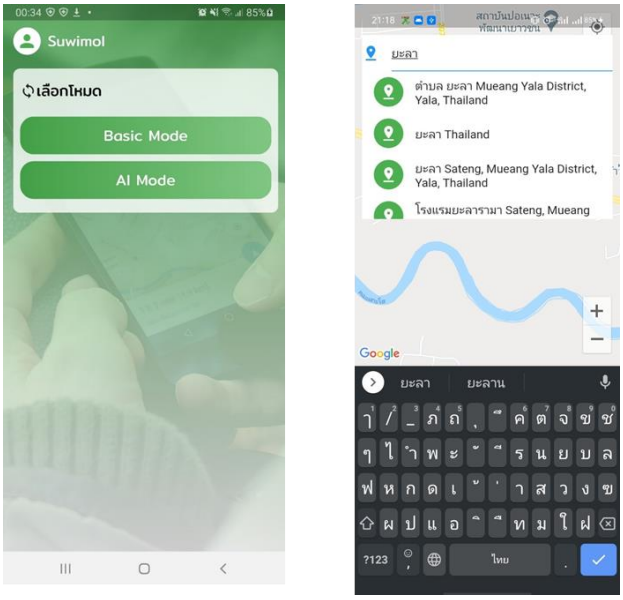

Figure 4 Shows the screen for selecting the working mode of the system and the screen for destination information input.

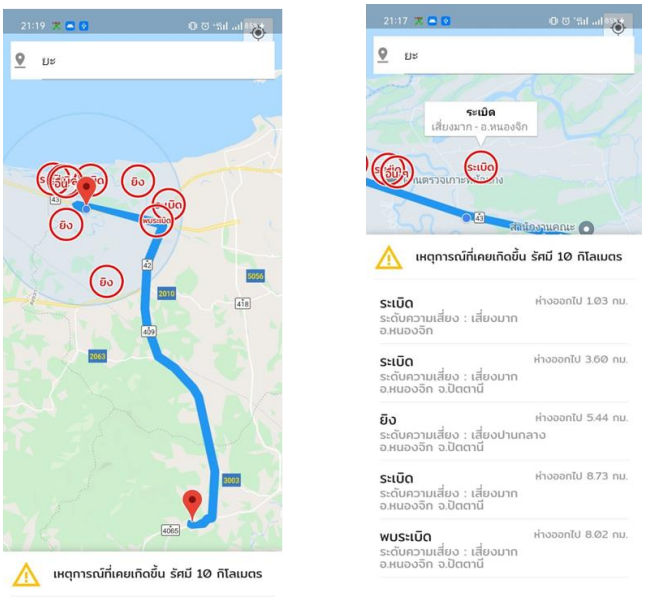

Figure 5 Shows the screen of the alert notification system on mobile devices for the high-risk area in basic mode.

Second, the valuation of the usability of the mobile risk area notification system for the three southern border provinces in Thailand.

The average and standard deviation were found to be 4.31 and 0.59, respectively, for the capability evaluation. The system was rated as being at a good level based on the evaluation results.

For the usability evaluation, the average and standard deviation were found to be 4.36 and 0.57, respectively. The

system's usability was also rated at a good level based on the evaluation results.

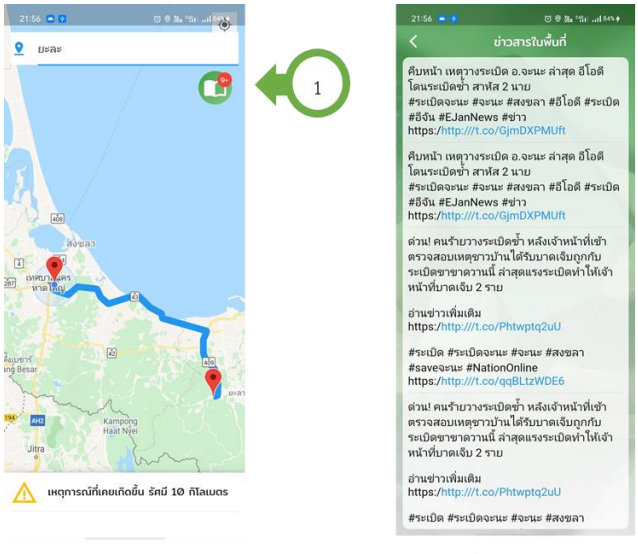

Figure 6 Shows the output screen of the mobile risk area notification system for the three southern border provinces using social media data.

V. CONCLUSION

This paper presents an enhanced mobile risk area notification system via social media data for the three southern border provinces in Thailand. The system serves as an application for the general public who search for information regarding the unrest situations occurring in the said provinces. It provides users with safer travel and daily living options in these risky areas. Not only does it reduce risks for users and the general public, but it also decreases the expenses incurred due to such risks, including medical costs for both households and the government. The objectives of this research are (1) to develop a mobile risk area notification system for the three southern border provinces, which alerts users about risky areas based on information from various sources, such as databases and online social data, and (2) to develop a social media data collection approach for a mobile-based risk area notification system.

The structure of the mobile risk area notification system for the three southern border provinces includes three main menus: (1) Login, (2) Register, and (3) Information. After logging in, the system directs users to the mode selection page, which offers two options: (1) Basic Mode, where the system fetches event data from the previous step (Rule-Based Technique), and (2) AI Mode, where the system will notify users of risk area information based on data collected from various sources, including databases and online social platforms. The system utilizes the Google API to detect the user's mobile location and provides route options for the user's selection.

After completing the program development, evaluations were conducted using questionnaires for both experts and general users. The average and standard deviation were found to be 4.31 (SD=0.59) and 4.36 (SD=0.58), respectively. Based on the evaluation results, it can be concluded that the mobile risk area notification system for the three southern border provinces demonstrates good performance.

Possible future development directions for the mobile risk area notification system for the three southern border provinces using an AI-based technique involve several aspects, such as adding a situation awareness method for the notification system and improving the responsiveness of the technology to enhance its flexibility. Moreover, integrating diverse data from social networks to consider for notifications can be beneficial.

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REFERENCES

[1] Insurgency in the Southern Border Provinces of Thailand. Retrieved November 29, 2019, from https://en.wikipedia.org

[2] P. Kai-nunna, “The State of the Art: Research on Journalism in the Southernmost Thailand Conflict.” Journal of Management Science Chiangrai Rajabhat University, 2019, vol. 14(2), pp. 64–86, from https://so03.tci-thaijo.org/index.php/jmscrru/article/view/128179

[3] N. Tungsangprateep, M. Chummuangpak and W. Jongwilaikasaem., “The Dynamic of Alternative Media in the Digital Age and Peace Journalism in the Southernmost Provinces of Thailand.” Journal of Journalism, 2020, vol. 13(3), pp.128-159, from https://so06.tci-thaijo.org/index.php/jcmag/article/view/244528

[4] A. Smirnov , A. Kashevnik, N. Shilov, N. Teslya and A. Shabaev., “Mobile application for guiding tourist activities: tourist assistant-tais.” In Proceedings of 16th Conference of Open Innovations Association FRUCT, 2014, pp. 95-100.

[5] A.Jeh-sa., “The Role of the Personnel Development Office in Problem Solving in the Southern Border Provinces”, Master's Thesis. Songkhla: Prince of Songkla University.

[6] A. Mayao-ga-se., "Impacts of the Insurgency in the Three Southern Border Provinces." Ratchaphak Journal, 2016, pp. 405-417.

[7] F. Yuroh and S. Chongthong., “Application of Geographic Information Systems to Assess Areas at Risk of Landslides in the Luang National Park Area, Nakhon Si Thammarat Province.” Master's Thesis. Surat Thani: Prince of Songkla University, 2016.

[8] C. Chalermsook, A. Kumpliw and M. Chalopyin., “Development of Disaster Alert Application for Thai Society.”, Master's Thesis. Bangkok: Asia University, 2018.

[9] C. Thepprasit, “Flash Flood Monitoring and Warning System.” Master's Thesis. Bangkok: Kasetsart University, 2006.

[10] C. Keeratvibulvech, “Flood Warning Using Artificial Intelligence and Social Media”. Knowledge Repository, National Institute of Development Administration. Retrieved January 23, 2020, from https://repository.nida.ac.th/handle/662723737/4415?locale-attribute=en