PROJECT SIGAW: A COMMUNITY-BASED INCIDENT REPORTING AND MAPPING USING GOOGLE MAPS

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ABSTRACT

Community awareness plays a vital role in community development. In order to maintain awareness and address untoward incidents, a strong collaboration between authorities and its community should be built. This study presents the development of a community-based incident reporting and mapping system that serves as a tool for disseminating relevant public information, manage and monitor incident data, and visualize significant occurrences through geographical mapping and reporting using Google Maps Application Programming Interface (API). The method involves data visualization utilizing reverse geocoding approach to convert geographic coordinates to its actual city address and street names to display incident data markers on maps. Furthermore, to strengthen community engagement, the system provides functionality that enables individuals to confirm certain incident in their area allowing government agencies to monitor the validity of the incident. Results showed that city officials and society individuals found the said system to be useful to the community, especially to the participating government organizations to have a single, collaborative platform to coordinate with each other and improve their management tasks. Lastly, the findings illustrate that geographical visualizations and using color-coded incident markers on maps provide clear presentations of incidents enabling insights that can assist decision-making.

KEYWORDS – Google Maps, geographical mapping, incident reporting, data visualization, community awareness

INTRODUCTION

The crucial part of community awareness is the engagement of individual, group of people, or organizations. It is a process of collaborative efforts of different local people living in a specific area to support their needs and the improvements of their society [1]. The main goal of community engagement is to produce better communication, procure new resources and build a strong sense of trust in the community [2]. Moreover, it promotes situation awareness regarding community incidents to local authorities which has greater responsibilities in maintaining and managing community problems. Communities are composed of related individuals or organizations with the same interest and build connections as part of the society. Over how many years, the same community incidents arises that should be addressed not only by the concerned authorities but also the community itself.

However, despite of technological advancement, collaboration is still one of the problems of the communities. The need of technology-oriented reporting tools plays a vital role in community development through a strong collaboration and a better dissemination of relevant public information such as crime information, calamities happened in a certain area, and other community incidents [3]. Currently, police authorities and local government unit conduct public conference to inform the community. Nevertheless, most of incident records are written manually. Furthermore, relevant public information is also disseminated through news update from local reporters through televisions, radios, newspapers, and even social networking sites. Moreover, social networking sites are not enough to manage and

monitor incidents since it is not intended specifically for reporting and mapping incidents [4]. Also social media has an issue on the reliability of data.

Currently, there are several community-based reporting systems designed for a specific purpose. Some systems include Crime Mapping System to manage and track crimes happening in a certain location where the public visualizes crimes plotted on a map [5]. Also, a Disaster Management system which provides disaster response and recovery information in every calamities happening in a certain area. Generally, the main goal of these systems is to inform the public for their knowledge and awareness in the community. Thus, this study focuses on the development of incident reporting and mapping system in Zamboanga City. Zamboanga City is located in Mindanao and is the largest city in Zamboanga peninsula with a total population of more than 807,129 and a land area of 1,483.3849 km2 [6]. With this large geographical area and large quantity of population, it is expected that incidents are potentially growing. Common incident occurrences reported are health-related incidents, growing crime rates, disaster incidents and other hazardous event.

LITERATURE REVIEW

Situational Awareness

Primarily, situational awareness is concerned on knowing what is going on or being aware of what is happening in the environment and having a shared understanding of the information. In multidisciplinary settings, situational awareness is affected by abilities of individual members, their interaction with other people, and with the environment in which they collaborate. There are factors that affect individual awareness formation including environmental such as physical location, display arrangement and size, group aspects such as communication, use of collaboration tools, and team processes. Thus, it is of great importance in designing systems that is supported with situational awareness and sharing of SA among team members to ensure efficient and effective team coordination and decision making which results to collaboration and engagement [7].

The role of reporting and mapping tool in situational awareness

To attain community awareness, integration of different technologies must be utilized. Reporting and Mapping tools allows the users to report, access and track information based on their situations. Presently, there are many situational awareness tools that enable the people to interact with authorities in terms of crime-related, health-related and disaster-related concerns. More advanced systems are computerized incidents and crime mapping systems which people visualizes events on map, thus, it produces better and accurate results in managing and analyzing crime activities [8]. These tools enhance people to have greater understanding on the present community situations they have in a certain period of time. As stated, most community concerns are those hazardous incidents they have experienced or those incidents that are possible to happen.

Comparison of Incident Reporting Systems Feature Summary

Based on related literatures in situational awareness, the researcher examined and analyzed each existing system features and design approach. These systems provide inputs for the improvement of the capability and functionality of Project Sigaw System. Table 1 below shows the comparison of existing incident reporting systems such as Ushahidi [9], Project Noah [10], Crimemapping.com [11] and Project Sigaw with their features.

Table 1. Comparison of Incident Reporting Systems Feature Summary

Key Features	Ushahidi	Poject Noah	Crime Mapping	Project Sigaw
Incident Reporting Facility	✓	✓	✓	✓
Incident Filtering by type		✓	✓	✓
Incident Filtering by date	✓		✓	✓
Incident Analysis and Assessment		✓		
Interactive Mapping	✓	✓	✓	✓
Search location engine		✓	✓	✓
Multiple Data Streams	✓			

All systems have reporting facility as one of its key function. Moreover, interactive mapping is one of the required components since it visualizes incidents geographically. In addition, each system has its own supplementary features such as searching, filtering and even analyzing incidents to maximize its capability for public benefits.

METHODOLOGY

The main goal of this study is to develop a tool for incident reporting and mapping for community awareness. First, we identified the set of objectives, scope of the study, and research data needed in implementing the said system. An interview was conducted to the City Director of Zamboanga City police office and to the local officials of the three barangays in the city as our target respondents. With this, functional requirements were determined and analyzed. Generally, relevant information especially on the manual procedures in managing and monitoring incidents in the area as well as how information is being disseminated to the public were captured leading us to categorized major incidents as crime-related incidents, environmental, disaster, and transport related incidents.

In user design and analysis, the requirements gathered were transformed into different data models. Figure 1 below shows the system architecture of the system.

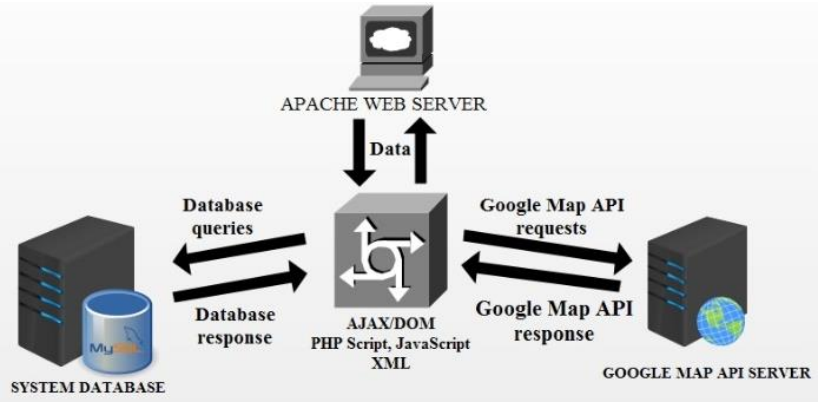

Figure 1. System Architecture of the Incident Reporting and Mapping

Figure 1 illustrates the different tools used during the development of the system. The system used an apache web server which handles the Hypertext Transfer Protocol or HTTP request from the user every time the user opens a web page. The apache server was connected to MySQL database to manage the retrieving and storing of data in every transaction made by the user. AJAX/DOM, JavaScript, JQuery and PHP script and Google Maps APIs were also utilized specifically on geocoding services and Google Maps integration. In performing reverse geocoding, we first create a geocoder object that retrieves latitude and longitude coordinates as parameters in geocoder request function [12] and formatted the results to the actual address including the city and street addresses readable by the user

The system was implemented in two iterative cycles. In every cycle, the prototype was tested and evaluated by the target users. We conducted an end-user testing for the first iteration cycle where checklist questionnaires were given to selected target users particularly two (2) police personnel, three (3) barangay officials and eleven (11) community residents from different barangays in Zamboanga City. The respondents rated the system based on four categories such as presentation of contents, user-friendliness, system functionality, and the system's overall performance. A recommendation section was also included in the questionnaire. The end-user rating was based on a summative scale rating process, where, in every question, there were five choices with a corresponding weight and interpretations. The weight represents the degree of satisfaction of the respondents towards every function on the given questions. The weight starts at 1 which interpreted as Strongly Disagree, 2 as Disagree, 3 as Undecided, 4 as Agree, and 5 as Strongly Agree. Ratings were computed according to the weighted mean of each question per category.

In the interpretation of results, the average rating for every category was computed using the formula:

$$A = \frac{1}{n} * \sum_{i=1}^{n} x_i$$

where:

A = average (or arithmetic mean)
n = the number of terms (e.g., the number of items or numbers being averaged)
x_i = the value of each individual item in the list of numbers being averaged.

To compute the mean, we tallied the number of respondents who rated as Strongly Disagree, Disagree, Undecided, Agree, and Strongly Agree per question in every category, and divided the summation to the total number of respondents. Then percentages were taken by multiplying the computed mean by 100.

RESULTS AND DISCUSSION

The results reveal three (3) positive key points from the evaluation made relative to the use of Google maps in reporting and mapping incident data within the community. These includes clear visualization of data using color coded incident markers on map, view incident data geographically instead of viewing it in tabular form, and improving the process of information dissemination and validity of incident data. Majority of the respondents were satisfied of the system's incident management tasks such as reporting, confirming, modifying, and filtering incidents records. The images in figure 2 and 3 show the result of the development of the system as main interfaces.

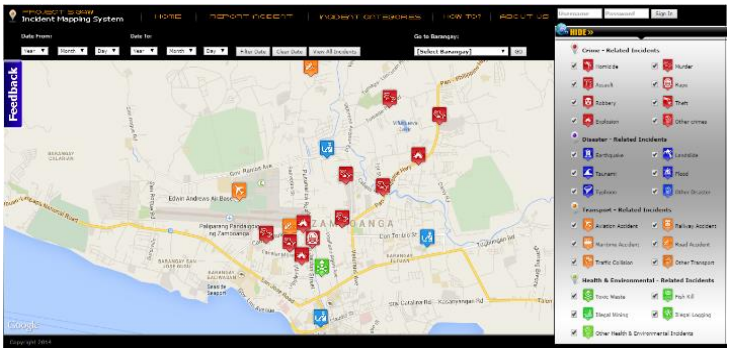

Figure 2. Homepage of Incident Reporting and Mapping System

Figure 2 is the homepage showing all incident markers on map as the default display of the system. Features include filtering of incidents by date, selecting incidents by type, reporting of incidents, confirming of incidents, and posting feedback or comments.

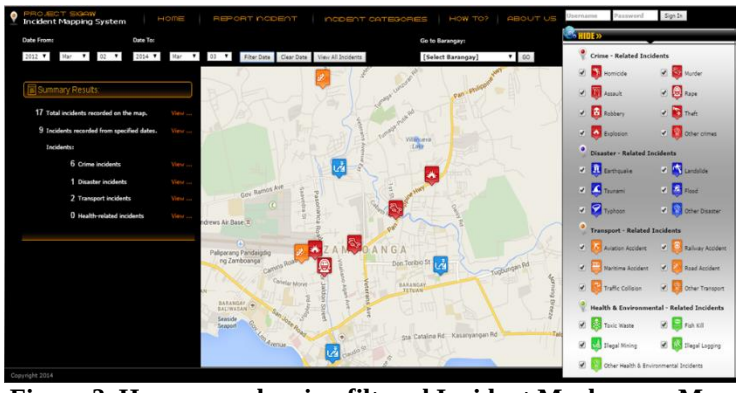

Figure 3. Homepage showing filtered Incident Markers on Map

Figure 3 shows filtered incident records of the system based on user's preferences. Incident records can be filtered by date given a certain date range allowing city officials to dynamically assess the increase and decrease of incident rate. Additionally, the system also provides summary results of all incident records.

Indeed, the system supports in the collaboration process between the community and the authorities. Any individual can report an incident from their respective areas. Overall, the result of the evaluation showed that most of the end-users were very satisfied with the functionality of the system. Aside from providing valuable information, the system also lessens the tasks in monitoring different kinds of incidents happening in the city. Figure 4 below illustrates the result of the end-users' evaluation of the overall functionality of the system. The respondents were consists of city officials, police personnel and selected individuals in the city.

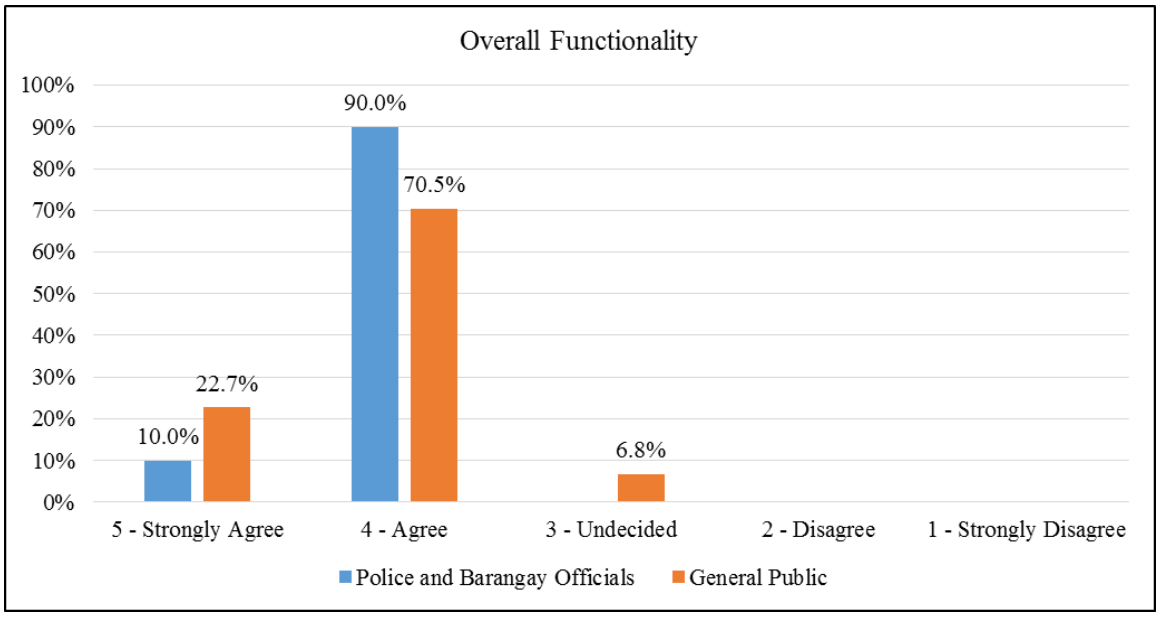

Figure 4. End-users Evaluation based on Overall Functionality of the System

Specifically, most of the respondents agreed that the map icon markers are clear and descriptive. The respondents stated that it is more effective to view incident data geographically, wherein, they visualized incident location directly on the map allowing the users to categorize and evaluate incidents based on the number of occurrences in a specific area. Most of the respondents also highlight the process of validating incident data from the day it was reported, confirmed by authorities, and verified by individuals who observed the incident in the community.

CONCLUSIONS

The study aimed to design and develop a community-based incident reporting and mapping system to allow local authorities such as police personnel and city officials to monitor and disseminate information to the community. The system supports in the collaboration process between the community and the authorities. It provides a better way of disseminating verified public information from reliable sources in such a way that the public can access and view significant occurrences through geographical mapping in their current locations.

With the used of Google APIs, incident records were easily plotted on the map. Furthermore, map coordinates particularly the longitude and latitude points were converted to human readable addresses which are essential in the reporting and mapping functions of the system. However, there is a need to maximize map addresses in Zamboanga City, where in, some places and locations are still lacking.

In providing quick access of information, the system's filter incident features helped the end-users to easily identify incidents that happened on a specific date as well as viewing incidents by type. Moreover, citizens can report incidents from their barangays which may lessen the number of unreported incidents in the area. With this scope, police authorities and city officials especially from rural areas were able to monitor and share their situations to other barangays within the city. Overall, the result was favourable. This indicates that the system was useful to their jobs and organizations.

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