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Leveraging Crime Reporting in Metro Manila Using Unsupervised Crowd-sourced Data: A Case for the iReport Framework

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Abstract – Crimes are acts that provide harm to an individual or community. It disrupts peace, produces fear and impedes the usual activities of the many. Sadly, statistics say that there is a significant number of crimes in the Philippines that are not directly reported to the proper authorities. This menace if not provided appropriate actions will continue to exist and provide terror to the community. This study proposes the development of a mobile application that collects indexed crime reports in Metro Manila through unsupervised crowdsourcing data. It aims to provide a venue for victims of crimes to report their experiences without having to go directly to police stations. Those who have experienced the same offense in the area can link their reports with those previously reported offenses which refer to the same case. This would provide authorities several views about the situation that could help them in their investigation to ensure that culprits are apprehended immediately. Future works include crime analytics for crime prediction and prevention.

Keywords— Crime Reporting; Indexed Crimes; Unsupervised Crowd Sourcing data; Mobile Application; Geolocation;

I. INTRODUCTION

The advent of Web 2.0 paved the way for people not to just simply consume information from the internet but also produce relevant information [1]. The exchange of information from the public has led to numerous applications including research initiatives helping different parts of the society (e.g. PatientsLikeMe.com) [2]. Social media websites are becoming a frequent venue for delivering emergency cases during disasters [3]. In the Philippines, after the onslaught of typhoon Haiyan, studies have shown that the affected public regardless of their extraordinary situations has used twitter to post their conditions and communicate with those who are also affected [4].

Through these social media platforms, people outside the affected area(s) are given a bird's eye view of the aftermath of the disaster. It provided an excellent platform where first responders can get data about the aftermath [5]. This shows how the exchange of information from the public is becoming a dominant tool in producing relevant data that can be used both by those who are and are not involved in the relay of information.

Crimes are acts that provide harm to an individual or community. It disrupts peace, provides fear to a community and impedes usual activities of the many. Crimes are a menace to the society that needs to be given wide attention. The solutions to solve and reduce if not eliminate crimes is not just a problem of the government but the entire society. The Philippine Statistics Authority (PSA) in its 2016 report stated an increment in crimes from 2012 to 2014. A total of 217,812 crime reports were recorded in 2012, 1,033,833 in 2013, and 1,161,188 were reported in 2014 with only 36.97% and 28.56% solved cases in 2012 and 2013 [6]. The report, however, did not include crime statistics in 2015.

The PNP in April 2016 has said the top 15 cities in the country which had the most number of index crime from 2010 to 2015. The index crimes include murder, homicide, robbery, theft, carnapping and physical injury. Out of the 15 cities, it was Quezon City who got the highest number crimes totaling to 65,514 cases of the of the 338,116 crimes reported. Manila came after Quezon City followed by Cebu [7]. Baquisal reported that the survey provided by the Social Welfare Service (SWS) showed that in 2014, 7.5% or 1,650,000 out of the 22,000,000 households had become a victim of crime six months before the conduct of the survey (one crime per household). However, per the Philippine Statistics Authority (PSA), crimes that were reported amounted to 1,161,188. This means that at least 29% of the offences were not recorded [8]. Although the reasons were not disclosed, the number is quite alarming as crimes are committed without proper actions taken to apprehend the culprit. In a study conducted in a University in the United States, it was found out that crimes go unreported due to 1.) fear of repercussions, 2.) ashamed to report the crime (e.g. crime committed by a relative), 3.) believes the crime does not warrant reporting, and 4.) reporting will not make any difference [9]. However, if no proper actions are made with the act, the crime might reoccur thus continuing causing havoc to the community.

Recently, it has been observed that in the Philippines, there is an increase of unlawful acts being posted in social

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media rather than being directly reported to proper authorities [10]. If the post gets enough attention, it is shared like wildfire with netizens asking for proper authorities to act on it. Once the media gets a hold of the post, media pressure is built on the authorities to provide appropriate actions.

Online crime reporting has been used by other countries to help their community report any criminal activities. Unreported crimes are not just prevalent in the Philippines but also rampant in other countries. As discussed in the review of related literature, there are some mobile applications in other countries which are intended to help its citizens report crimes using what seems to be the most accessible technological tool that they have, their smart phones. In India, a mobile application for crime reporting was proposed that would enable victims of crimes to report the act to the police immediately and therefore provide immediate response [11]. However, one problem seen here is that there is a possibility that the criminal may have already escaped before the police arrive. Since the application does not allow other people to see the report neither give them the ability provide similar reports in the same area, the tendency is that the crime may reoccur again victimizing other individuals oblivious of the persisting crime.

The objective of the study is to develop a mobile application that focuses on the collection of indexed crime activities in Metro Manila through unsupervised crowdsourcing data. The proposed system will allow multiple reports in one criminal act from various sources (crowd) providing authorities with different angles of the case through the collected data from the crowd (pictures, videos, and descriptions of the case). The system will depend on geolocation data to detect the precise location of the victim to provide accuracy to the report. The role of the public is of high paramount as they will be responsible for connecting reports that refer to the same case. This feature exists in the mobile application that was proposed by Ng [12]. The crowd also can validate the post if it is a hoax or unrelated by using the like and unlike buttons for each post created. The administrator of the system will approve if the reports are the same based on the data provided by the users.

The system will provide an avenue for police officers determine crimes that are not reported to them. As mentioned, one reason that was identified of why victims do not report crimes is the thought that reporting will not make any difference at all (e.g. grifatti). However, if these acts are not reported, chances are crimes will eventually reoccur. The proposed system will allow the public view the different index crimes in their area. This is to give them an opportunity to provide similar reports that they might have experienced in the area in which they failed to report. Through the shared crowdsourced data, the public together with the proper authorities will mutually benefit from the information produced.

II. Review of Existing Studies

Smart mobile phones used in the country has increased dramatically due to the entrance of local manufacturers that are far cheaper and has similar capabilities compared to its major counterparts. In a study conducted in the United States, 85% percent of mobile users make use of the non-native applications installed on their smart phones [13]. Most of these applications are social media platforms where collaboration and data crowdsourcing are taking place. Crowdsourcing permits a large group of people to exchange valuable information that does not rely on supervision. Hence, the term Unsupervised crowdsourcing data. Applications of crowdsourcing include traffic problem management [14], identification of disaster relief needs, and crime reporting [15] to mention a few.

Various literature, on the other hand, has been written about mobile crowdsourcing for crime reporting in other countries. One paper studied six (6) different applications for crime reporting regarding its capabilities vis-à-vis their evaluation criteria [1]. The existence of these applications in the literature tells us that it is possible for the public to report crimes by using a mobile application with high acceptance rate.

In the Philippines, the literature provided one application that permits crime reporting. The application named STREETWatch allows individual report crimes to the nearest authority. The application detects the user's current location and shows the closest police precinct in the area based on the user's location [16]. The geolocation capabilities of smartphones in crime reporting can be used to mark individuals who report crimes thus promoting a better response from the authorities [17] [18]. This application can still further be improved by allowing the eyewitnesses to contribute to the crime associated in the area. The public will link reports that are related to one another thus giving the authorities gather more evidence of the offense.

Also, one challenge observed from this app is that there is a possibility that users might provide false reports. There is no way for users to identify whether the reports provided are true or not.

III. Research Methodology

The method used for the study relied heavily on the review of related studies. The development of the system, on the other hand, followed the rudiments of Agile Method. Several studies have concluded the benefits of Agile Methodology due to its adaptability to meet changing demands and needs [19]. Studies also show that agile method for mobile application significantly speeds up the completion of the project through iterative development and continuous customer feedback [20].

Mobile-D is an agile approach for mobile development which has been continuously used by developers in doing mobile application due to 1.) Visibility of progress, 2.) earlier discovery and fast repair of technical issues, and 3.) constant advances in development [21].

Mobile-D contains the following five phases (fig.1) 1.) Explore, 2.) Initialize, 3.) Productionize, 4.) Stabilize, and 5.) System Test and Fix [22]. The customers that refer to the development stage are the proponents. As analysts, they are responsible for identifying what features and functionalities should be included based on the synthesis of the review of existing literature and studies. The proponents together with the developers of the system worked hand in hand until the system was completed.

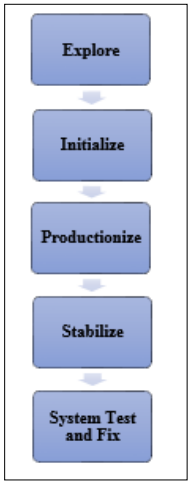

Fig.1. Mobile-D Phases

IV. System Development

This section provides the system paradigm of the mobile application, use case diagram and the system features of both the mobile and web application.

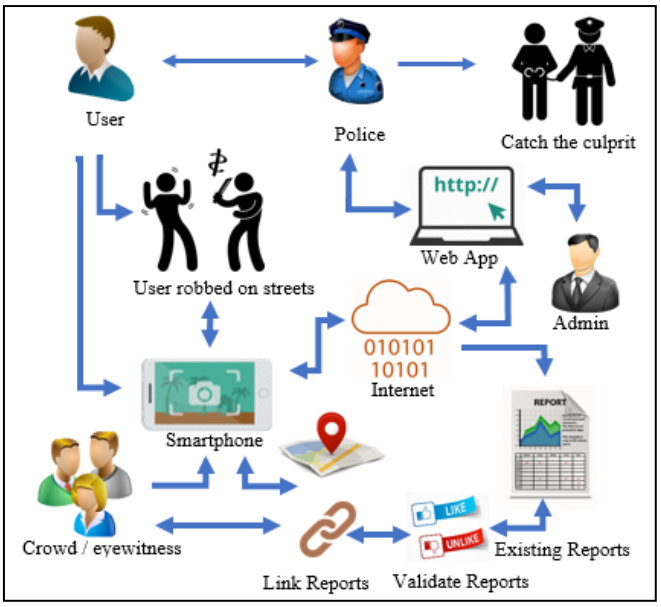

Fig.2. System Paradigm

A. System Paradigm

The System Paradigm as depicted in Figure 2 shows the processes involved in the proposed mobile application. The main users are the public who provides information to the cloud and the Police authorities who consume this information. The public also benefits from the information in the cloud as they will be informed of the persisting crimes in each area. Being informed means that they will have better decisions on what to do when they are in a given area.

The role of the public is to produce more evidence in a previous crime by allowing them to add comments with pictures and videos. The assumption is that those who added pictures were eyewitness or have experienced the same situation in the area. To validate posted crimes and the comments attached to it, the public may use the like and unlike button to denote the possibility of a false crime act. Those with high like posts will be prioritized and placed on the upper list of the screen and those with high unlike reports will not be given priority and will be displayed on the bottom part of the screen. The validation of the reports highly depends on the users themselves.

The police authorities are responsible for scouring criminal acts from the web application. The police use the reports of the public to apprehend culprits and provide better intervention for the public's safety. Once a crime is solved, the police authorities can mark the offense as solved in the map. The role of the admin (Philippine National Police – National Capital Region Police Office – Metro Manila) on the other hand is to remove posts that have high unlike tags denoting the possibility of false reports published on the application. They will also be responsible for managing crime tags created by the public.

B. System Features

The features of the mobile application include 1.) Send Report Module, and 2.) View Reports Module. Both modules have sub modules which will be discussed accordingly. The web application, on the other hand, contains the 1.) View Reports Module.

1) Report Module

The Report Module allows users to report criminal incidents or acts in an area. The geolocation data of the user's smartphone will be used to tag the area where the report will be created. Presently there are nine index crimes that can be tagged in the mobile application (see figures 3 & 4). More tags can be added as other crime reports are added to the system.

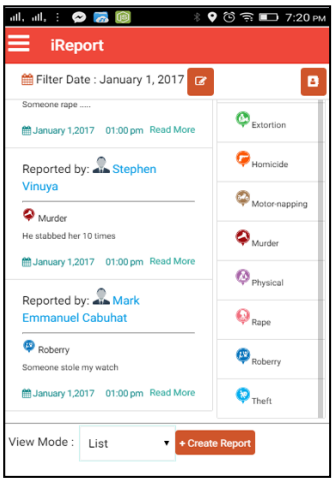

Fig.3. List View Mode

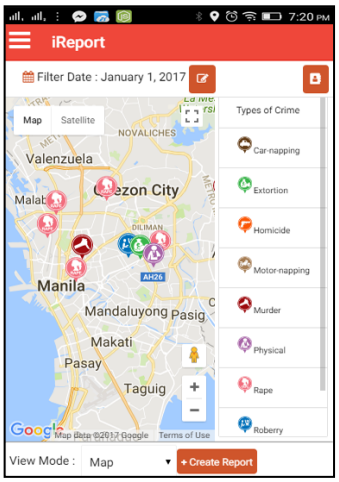

Fig.4. Map View Mode

Before a report is created, the user has two view mode options to see, 1.) List View (figure 3) and the 2.) Map View (figure 4). The view modes give the user different ways of seeing crimes in an area.

The user can also select which type of crimes do they wish to see by clicking one of the various crime tags found in the right area of the mobile app of the screen. The phone will detect the location of the user and will zoom in the map giving him/her the different crimes persisting in the area.

Once the user selected the create report button, the user has three steps to follow. The first step includes describing the report (figure 5). The user must enter the type of crime, date, time, and a brief description of the incident.

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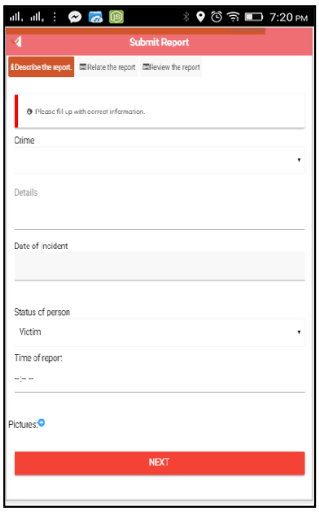

Fig. 5. Describe the report view

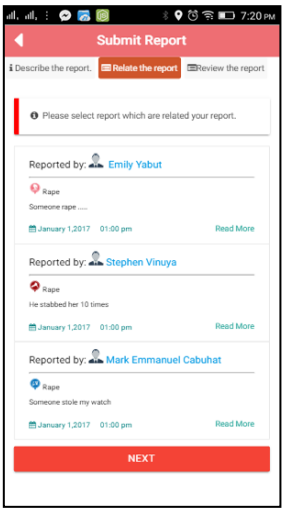

Fig. 6. Relate the Report View

Optional pictures can be added to the report that can serve as evidence of the crime. After adding the necessary details, the user will move to the second step (figure 6). This step is used to relate reports to previously posted reports. The user will check whether his report pertains to the same report (e.g. hit and run, robbery).

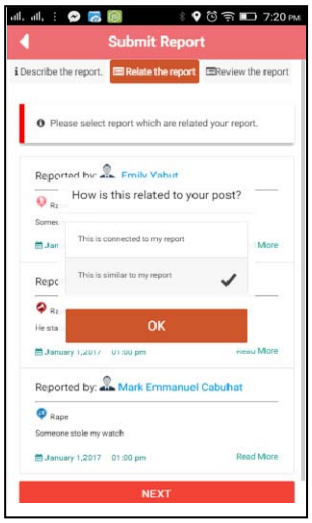

Fig.7. Relate Report Module

If the user wants to link a story, two options will be shown, namely 1) This is connected to my report, and 2.) This is similar to my report (figure 7). The first option would mean that the report is directly connected to what was posted (e.g. Same incident report) and the second option would mean that your report is similar to the previous one (e.g. pickpocketing in the same area but varies differently in time). If there is no similarity to any of the previous reports, the user may opt to click the next button.

Once the user clicks next, the third step will follow. On the last step, the user must review his/her report Once the report is already done, the user clicks the publish button to upload the report.

2) View Reports (Mobile App)

The View Reports option will allow users to view existing reports in an area. The user can click like and dislike to denote validity of the report. In addition, this view lets users show their posted reports. It serves as a repository of the user's previous reports.

3) View Reports Module (Web app)

The mobile app allows users to see actual crimes that have not been solved yet by the police. A user can filter and view the different types of crimes in each area but cannot make a report through the web app. Reporting is only done through the mobile application. The web app also provides another view that presents all solved crimes by the authorities. These solved crimes will not apply to the mobile application

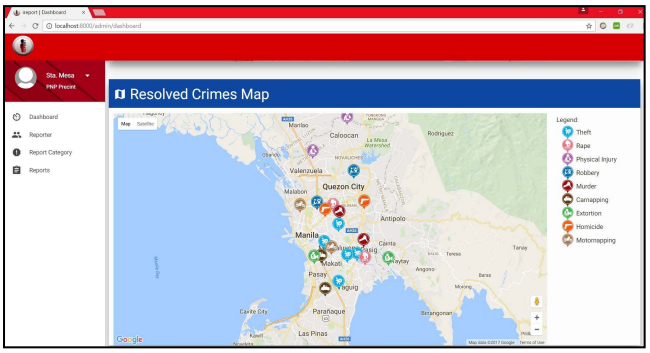

Fig.8. Police Precinct View

The role of the police precincts is to mark unsolved crimes as solved. This feature is only for police precincts. They can mark crimes as solved only under their area of jurisdiction.

Once a crime is solved, it will no longer appear in the mobile application.

The admin side, however, sees the different tags made by the user aside from the pre-existing tags. The role of the admin is to manage these tags by linking similar tags or translating tags written in Filipino to English.

C. Use Case Diagram

The Use Case diagram describes the different interactions of the user to the system. The users who are the crowd and the authorities work hand in hand to get valuable information from the data provided by the public. Figure 9 shows this interaction

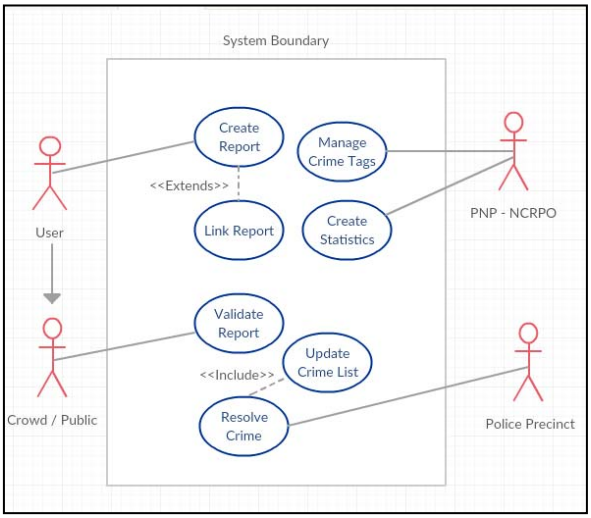

Fig.9. The Use Case Diagram

V. Recommendations and Conclusion

The system was developed to help leverage crime reporting in Metro Manila. With the application, the public can report criminal activities that they have witnessed or experienced. This would give users of the application convenience in reporting crime as it is reported through their mobiles phones. The system relies on the data provided by the public including the validation of reports posted.

The review of related studies has also shown existence of similar applications denoting acceptability of such technology. In the Philippines, one application exists in the literature but it failed to provide validation of reports.

The proponents recommend implementation of the app to the stakeholders to assess its acceptability and determine constraints related to its implementation. Additionally, crime analytics can be integrated after a year of implementation.

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References

[1] I. Ariffin, B. Solemon, W. M. Luqman and W. Abu Bakar, "An Evaluative Study on Mobile Crowdsourcing Applications for Crime Watch," in *2014 International Conference on Information Technology and Multimedia*, Putrajaya, 2014.

[2] C. de la Loge, S. Dimova, K. Mueller, G. Phillips, T. L. Durgin, P. Wicks and S. Borghs, "PatientsLikeMe® Online Epilepsy Community: Patient characteristics and predictors of poor health-related quality of life," *Epilepsy & Behavior,* vol. 63, pp. 20-28, 2016.

[3] H. Dong, M. Halem and S. Zhou, "Social Media Data Analytics Applied to Hurricane," *2013 International Conference on Social Computing,* pp. 963-966., 2013.

[4] B. Takahashia, E. C. Tandoc Jr. and C. Carmichael, "Communicating on Twitter during a disaster: An analysis of tweets during Typhoon Haiyan in the Philippines," *Computers in Human Behavior,* vol. 50, p. 392–398, 2015.

[5] D. Murthy and A. J. Gross, "Social media processes in disasters: Implications of emergent technology use," *Social Science Research,* vol. 63, p. 356–370, 2017.

[6] "The Philippines in Figures 2016," Quezon City.

[7] ABS-CBN, "Top 15 cities with highest index crimes," 01 April 2016. [Online]. Available: http://news.abs-cbn.com/focus/v2/04/01/16/top-15-cities-with-highest-index-crimes.

[8] J. K. Baquisal, "Dealing with Criminal (In)Justice in the Philippines," 22 March 2016. [Online]. Available: http://halalan.up.edu.ph/fact-check/271-dealing-with-criminal-in-justice-in-the-philippines.

9] A. Iriberri, G. Leroy and N. Garrett, "Reporting On-Campus Crime Online: User Intention to Use," in *Proceedings of the 39th Annual Hawaii International Conference on System Sciences*, Hawaii, 2006.

[10] G. L. Novio, J. A. M. Cruz, J. C. N. S. Deinla, M. J. T. Rollan and B. S. Fabito, "Empowering consumers in selected Public Markets in Metro Manila: A framework for the development of AgriWatchPH," in *Region 10 Conference (TENCON), 2016 IEEE (pp. 2236-2241).*, Singapore, 2016.

[11] D. Lal, A. Abidin, N. Garg and V. Deep, "Advanced Immediate Crime Reporting to Police in India," *Procedia Computer Science,* vol. 85, p. 543 – 549 , 2016.

[12] V. T. Y. Ng and L. H. Leung, "Collaborative Incident Reporting with Linked Heterogeneous Information," in *2012 Eighth International Conference on Signal Image Technology and Internet Based Systems*, 2012.

[13] B. S. Fabito, F. F. Balahadia and J. D. N. Cabatlao, "AppLERT: A mobile application for incident and disaster notification for Metro Manila.," in *Region 10 Symposium (TENSYMP), 2016 IEEE*, Bali, 2016.

[14] A. Artikis, M. Weidlich, F. Schnitzler, I. Boutsis, T. Liebig, N. Piatkowski, C. Bockermann, K. Morik, V. Kalogeraki, J. Marecekm, A. Gal, S. Manno, D. Kinane and D. Gunopulos, "Heterogeneous Stream Processing and Crowdsourcing," in *Machine Learning and Knowledge Discovery in Databases*, Springer Link, 2014, pp. 520-523.

[15] S. Shah, V. Tech, C.-T. Lu and I.-R. Chen, "CROWDSAFE: crowd sourcing of crime incidents and safe routing on mobile devices," *Proceedings of the 19th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems,* pp. 521-524, 2011.

[16] M. C. G. Fernando, "STREETWATCH: A Mobile Application for Street," in *TENCON 2015 - 2015 IEEE Region 10 Conference*, Macauo, 2015.

[17] W. Jakkhupan and P. Klaypaksee, "A web-based criminal record system using mobile device: A case study of Hat Yai municipality," in *2014 IEEE Asia Pacific Conference on Wireless and Mobile*, 2014.

[18] C. Oduor, F. Acosta and E. Makhanu, "The adoption of mobile technology as a tool for situational crime prevention in Kenya," in *2014 IST-Africa Conference Proceedings*, 2014.

[19] S. Rana Muhammad, Q. Salman, I. ul Hassan, B. Rab Nawaz and G. Yasir, "Testing Automation in Agile Software Development," Journal of Innovation and Applied Studies, no. 9.2, pp. 541-546, 2014.

[20] K. Asra, Z. Sobia and M. Fahad Khan, "Suitability and Contribution of Agile Methods in Mobile Software Development," International Journal of Modern Education and Computer Science, no. 6.2, pp. 56-62, 2014.

[21] A. C. Spataru, "Agile development methods for mobile applications," School of Informatics. University of Edinburgh, UK, 2010.

[22] "Mobile-D," Agile Software Technologies Research Programme, [Online]. Available: http://virtual.vtt.fi/virtual/agile/mobiled.html. [Accessed 20 February 2017].