Enhancing Barangay Justice System through the Development of a Web-based Crime Monitoring Module

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Abstract

A secure and harmless environment is a very much important aspect in promoting investment and economic growth. In a community in particular, peace and order has always been a pressing issue. In order to do the things they need to survive, everyone should be able to feel safe all the time. Public safety officials are aware that protecting their people, their properties, and the environment are among the utmost important responsibilities they need to perform. To be efficient in performing such functions, this study focused on the development of a Web-based Crime Monitoring Module, which enhances record keeping, and management of offenses in the community. The system provides a more effective way of monitoring offenses and blotter cases in the selected barangays that leads to better administration of peace-and-order. A crime-mapping scheme is integrated in the system by embedding a Google Map where the administrator can easily tag the reported crime or blotter case within the barangay. Through this, a crime hotspot can easily be determined. The Agile Model was used for the design and development of the system. The model was used to emphasize on planning, requirement analysis, design, and building of an entire application. The system performance is proven satisfying and acceptable based on the result of Black Box Testing using the Test Case method.

Keywords: Crime Mapping, Barangay Management System, GIS, Crime Hotspot, Black Box Testing

1 Introduction

The Local Government Code of the Philippines defined barangay, which was enacted in strategies 1991, as functions as the principal planning and implementing unit of government policies, projects, campaigns, programs, and activities in the community, and aids as a medium wherein the collective opinions of the people may be expressed,manifested and considered and where disagreements may be harmoniously resolved (Robles, 2018). The barangay plays a significant part in the progress of the country and to some extent provides peace, order and security of the people (Boysillo, 2018). Each barangay has the so-called Katarungang Pambarangay or Barangay Justice System. Republic Act No. 7160 of the Local Government Code of 1991 mandated that the Barangay Justice System should be established and operated. These strategies were provided to barangay to promote peace and harmonious relationships among community members and to improve and make the justice system more reactive to the demands of the people. The elected barangay chairman is considered as the head of this system, which acts as the presiding officer and the chief executive of the local legislative council. The Lupong Tagapamayapa or the Peace and Order Committee, with members consisting of ten (10) to twenty (20) persons with integrity, fairness and goodness are chosen among those working and living in the barangay.

The government created various laws for the barangay's peace and order. Example of which is the bill entitled An Act Creating Barangay Community Peace and Order Council for the Utilization of Barangay Officials and Its Constituents on Crime Prevention and for Other Purposes. This strives to create a Barangay Community Peace and Order Council that will help the existing Philippine National Police (PNP) and Local Government Units (LGUs) solving various issues in peace and order matters like disaster management, traffic problems and prevention of crimes. At the barangay level, the PNP implements national and local projects or programs for the benefit of the people in the community.

In Bulacan Province, Philippines, Plaridel is considered as the first class municipality. Plaridel has a total population of 107,805 residents in the year 2015 and divided into nineteen (19) barangays which are Agnaya, Bagong Silang, Banga I, Banga II, Bulihan, Bintog, Culianin, Dampol, Lagundi, Lalangan, Lumang Bayan, Parulan, Poblacion, Rueda, San Jose, Santa Ines, Santo Nino, Sipat and Tabang. With the expansion of business activities in Metro Manila, Plaridel is part of Manila's built-in area of operations.

In the barangay level, to facilitate the processes of achieving peace and order most of the barangays in Plaridel have implemented the use of Closed Circuit Television or known as CCTV. The DILG in Plaridel stated that seventeen (17) out of nineteen (19) barangays have already implemented the use of CCTV.

Another thing of securing peace and order is by keeping track of records of offenses, crimes and incidents within the jurisdiction of the barangay officials by recording them in the book of records. These particular records are important to Local Government Units (LGUs) because they will be the basis of various barangay in the implementation of projects and planning activities like crime prevention. In fact, each barangay in Plaridel is needed to submit an estimated savings of the government and quarterly report of Katarungang Pambarangay Compliance Report where a list of cases are listed.

Most barangays in Plaridel have desktop computers in the barangay hall. Therefore, the retrieval and storage of information and records could have been enhanced. However, most transactions like recording of blotter cases and offenses are still done manually and Microsoft Word is used to produce reports. In terms of retrieval and storage of needed information, the barangay encounters error due to lack of user training and the availability of computer software slows down the opportunity of the barangay to maximize the power of computing.

Consequently, the barangay secretary manually does the generation or production of documents from the clearances, permits and the

records of disputes and even crimes and other reports. The records written in the blotter book are so unorganized that even the officials cannot monitor and determine if a certain case is already settled or need to follow up.

Upon observing this, the researcher understands the importance of developing a web-based crime monitoring system that will help the barangay to keep track records of various cases through tagging or mapping on the barangay map. The researcher also understands the importance of the barangay justice system, thus, by creating an automated system that would help the barangay to monitor and observe the status of blotter cases filed in their barangay will result in a better and efficient implementation of peace and order.

2 Objectives

General Objective
The general objective of the study is to develop and design a web-based crime monitoring module that would enhance the barangay justice system.

Specific Objective
This study has the following specific objectives:

1. To develop a web-based crime monitoring system with the following features:
    1.1 security module,
    1.2 file maintenance,
    1.3 incident blotters,
    1.4 crime mapping, and
    1.5 reports generation;
2. To integrate the crime mapping technology into the system;
3. To determine the crime hotspot in the barangay;

4. To evaluate the system using the black box testing.

3 Scope and Delimitation of the Study

The system allows tagging the blotter case to the barangay map. A map is embedded through Google Api. It can be viewed by road map or satellite. The administrator is responsible for tagging the case or crime to the Google map. He must be knowledgeable and familiar with the geographical location of all barangay puroks since Google maps are not capable of showing the exact location of the crime. Two types of crimes being displayed : index and non-index crime. The index crime is represented by the red icon while non-index is represented by the green icon. The plotting or tagging of crime to the map should be per barangay basis. In addition, the barangay chairman can also tag important places like chapel, school, barangay hall and hospital. There is a filter option that allows you to view the crime on the map by date, crime type and location.

The system can record and update hearing or reading of blotter cases. Once the offenses have been recorded, it follows the scheduling of the first, second or third reading of the offender and complainant. The system has a notification feature for a list of cases with reading schedule. Through this feature, it can monitor the condition of the case, like if the case is already dismissed, ongoing or dismissed with Certificate to File Action (CTFA). Another feature is the calendar where the user is allowed to view a list of reading schedules per assigned day.

The system allows them to update the user's configuration, manage the crime setting, and print various reports like crime record, hot spot and list of offenders and complainants. The system also has capability to send messages to other users in different barangay and can create messages and even view sent items. The system can compute the total blotter fee for the day and month. The complainant needs to pay for a certain fee. Payment is optional to other barangay while others are required.

On the other hand, the system is only intended for ten(10) barangays in Plaridel, Bulacan which include Sto. Nino, Lalangan, Agnaya, Lagundi, Poblacion, Banga I, Banga II, Lumang Bayan, Sipat and Parulan. Profiling of residents and households is not included in the system. The system can only be accessed online. It is available anytime for as long as there is an internet connection.

The system is capable of adding barangay. In addition, the barangays' latitude and longitude on the Google Map must specify. Once done, the newly added barangay will be included in the database and will have its own module. The only thing that can't be done is the applying of highlight color and stroke to set the boundary of the barangay map. The system is not capable of showing the exact location of purok for each barangay. Since the smallest unit that Google Map can offer is the barangay map, barangay's purok cannot be identified. That is why the system user is limited only to the barangay chairman or secretary for they are the only one knowledgable or familiar with the geographical location of the barangay. The Violence Against Women and Children (VAWC) or known as R.A. 9262 is not included in recording blotter cases. This is because VAWC has a separate concern and have a separate VAWC desk intended for the women and their children.

4 Methodology

The SDLC (Systems Development Life Cycle) is a series of tasks that a developer follows to create an information system. It is the multistep method of designing, implementing, maintaining, and retiring information systems, starting with initiation, study, design, implementation, and maintenance, and ending with disposal (Radack, 2017). The System Development Life Cycle (SDLC) is a model of a comprehensive strategy for developing and implementing software. SDLC is described as a comprehensive plan that outlines how software will begin and end its operation.

The Agile model is one of its development models. The agile model is a hybrid of iterative and incremental process models that emphasizes process adaptability and customer satisfaction through the rapid delivery of working applications. Every project should be done differently, according to the Agile model, and current approaches should be adapted to better fit the project requirements. To produce unique features for a release, tasks are divided into time boxes (small time frames) in agile. It is divided into five stages: planning, requirement analysis, design, building, and testing. The method is iterative, with each iteration delivering a working software construct.

Planning. The planning phase is the most important part of the software development process (Blanchard, 2006). The researcher carefully planned, especially in the early stages of designing the project, by coordinating with the different barangays in Plaridel on the blotter / crime monitoring processes and procedures that will be integrated into the system to effectively manage project risks. The depth and formality of project plans should be proportional to the barangay system's characteristics and risks. The knowledge gathered during the initiation step is refined in this stage by defining the relevant activities and processes.

Requirement Analysis. Also known as Software Requirements Specification (SRS) is a complete and comprehensive description of the behavior of the software to be developed (Inflectra, 2018). Under this phase, interviews and surveys were done with the barangay secretary, barangay chairman and selected barangay tanods regarding the peace-and-order related transactions in the barangay. The researcher then documents the process of reporting crimes and incidents, and the way they handle and record various offenses.

Design. During the design process, the researcher converts the informational, functional, and network requirements defined during the planning and requirement analysis phases into unified design specifications (Engstrom, 2006). Program designs can be built in a va-

riety of ways, as seen in this report. Using a top-down approach, the researcher first identifies and connects major and minor software components and interfaces, then expands design layouts as smaller subsystems and connections are identified and linked. Design phase composed of two levels. These are high-level and low-level architecture. The high-level architecture, databases and interface of the system should be done. The high-level architectural designs concentrate on the identification of software to be used and interface. The low-level design on the other hand, includes the creation of flowchart for the functional flow of the system and formulation of context diagram and data flow diagram (Tupper, 2015).

The researcher identified the software needed for the development of the system. Flowcharts, context diagrams and data flow diagrams were created. Also, the researcher focused on the development of the design of the crime monitoring system, which includes the graphical user interface (GUI).

Building. Converting concept requirements into executable programs is part of the building process. System specifications, which include narrative explanations of operating environments and the interrelated input, processing, and output functions of the system, were included in the development of the Web-based Crime Monitoring.

Testing. This refers to the realization of business requirements and design specifications into a concrete executable program, database, website or software component through programming (Bassil, 2012). Under this phase, the real source code is being compiled into an operational system. The researcher used PHP, Javascript and CSS for coding the system. Google map is embedded in the system for crime mapping to be possible. MySql was used for databases.

Testing is also known as verification and validation, which is a process for checking that a software solution meets the original requirements and specifications and that it accomplishes its intended purposes (Singh, 2017). During this phase, the researcher used the Black Box Testing, especially the creation of Test Cases to make sure

that the system worked as it was intended.

5 Research Result

Primarily, the system served its purpose of monitoring the crime and incidents in ten (10) Barangay in Plaridel, Bulacan that are geographically connected. Among these are: Sto. Nino, Lalangan, Agnaya, Lagundi, Poblacion, Banga I, Lumang Bayan, Sipat, Banga II and Parulan.

The respondents of the study are ten (10) Software Quality Assurance Specialists from IT Companies and ten (10) IT Instructors from Bulacan State University. They were asked to evaluate the Test Cases under Black Box Testing because of their expertise and knowledge in terms of evaluating and criticizing a system. Their experience in the industry or academe contributed a lot to evaluate the acceptability of the system. Other respondents are the ten (10) barangay chairman and ten (10) barangay secretaries came from the ten (10) subject barangays in Plaridel. Since they are the main users of the developed system, suggestions that came from them are highly valued and considered.

The study used an evaluation instrument to assess the target characteristics of the developed system. The evaluation instrument is based on the so-called Black Box Testing. It is also known as Behavioral Testing in which the internal code and the tester or evaluator does not know the architecture of the system. Under Black Box Testing, tests are done from the user's point of view and the user may not need to be an expert in any programming languages or the like (Bhasin, 2014).

Black box testing is a software testing technique in which functionality of the application under test is assessed without considering the internal code structure of the software and the details and knowledge of internal paths of it. This kind of testing is based completely

on the software requirements and specifications. The preparation for this kind of testing started by constructing test cases. Test cases were categorized into different modules. These are as follows: Login Functionality Module, Crime Mapping Module, Messages, Blotter Record, Blotter Mapping, Blotter Form, Other Layer, Other Layer Mapping, Crime Record Report, Crime Setting, User Configuration, Barangay Configuration, Profile, Tutorial and Logout.

The evaluators critically analyzed various inputs and outputs applicable for each module and executed each test case to validate requirements. As a result, all designed modules got a "Passed" result.

6 Discussion and Interpretation

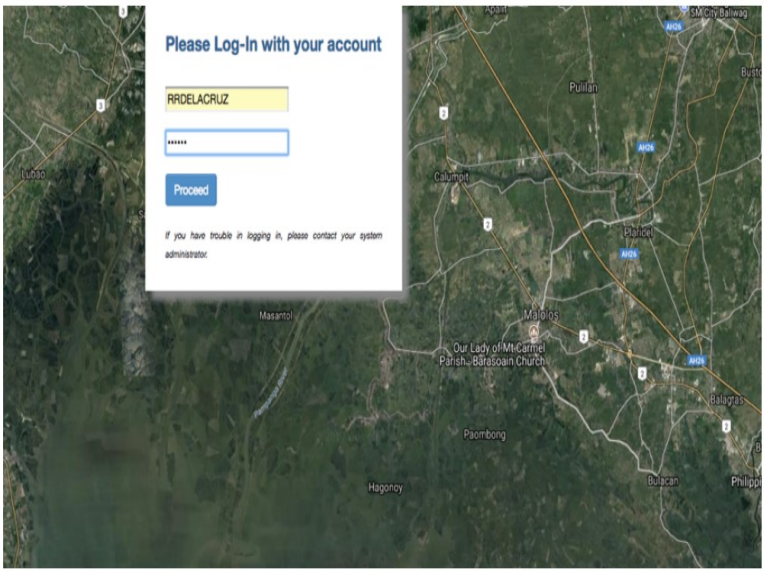
The main goal of the study is to develop a web-based monitoring module that can enhance the barangay justice selected barangay in Plaridel, Bulacan with the integration of crime mapping.

The developed monitoring system has the following significant features: security module, file maintenance, incident blotter, crime mapping, and report generation.

a. Security Module. The monitoring system has a security feature that can prevent illegal users from accessing the system. It provides username and password to use upon logging in. This prevents intruders in accessing the system. Both username and password are case sensitive.

Figure 1 shows the security feature of the developed system. The administrator must input a valid username and password in order to access his account.

Figure 1. Security Log in



Transaction password is different from the log in password in a way that the administrator has the ability to apply password on the major transactions of the system like the recording of blotter cases and crime mapping.

Figure 2 shows the page that has been locked. In order to unlock the page, the user must enter the transaction password

b. File Maintenance. The developed monitoring system has a file maintenance feature which includes crime settings, user configuration, barangay configuration and audit trail. File maintenance feature of the system gives control to add crime and other users, update barangay information and view the audit trail.

Figure 3 and Figure 4 show the form of adding crime and user to the system.

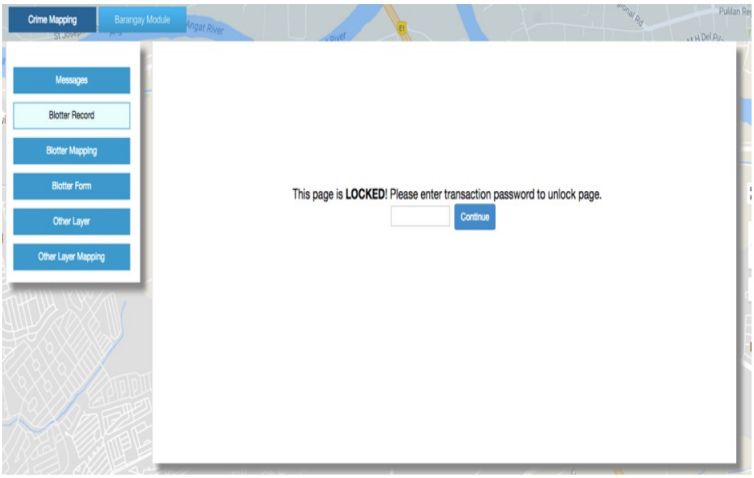


Figure 2. Transaction Password

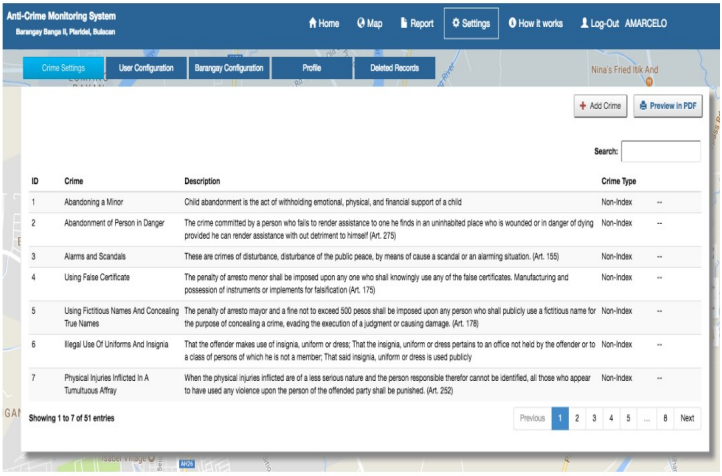


Figure 3. Crime Setting

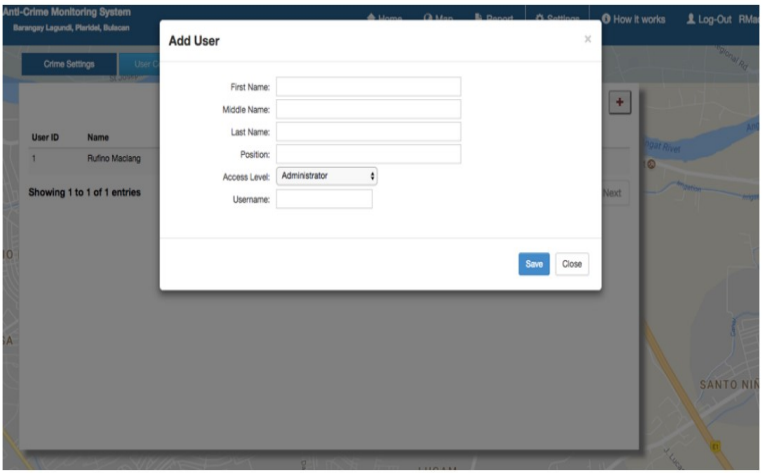


Figure 4. User Configuration

Barangay Configuration gives privilege to edit or update the barangay information. Figure 5 shows the form for updating the barangay information.

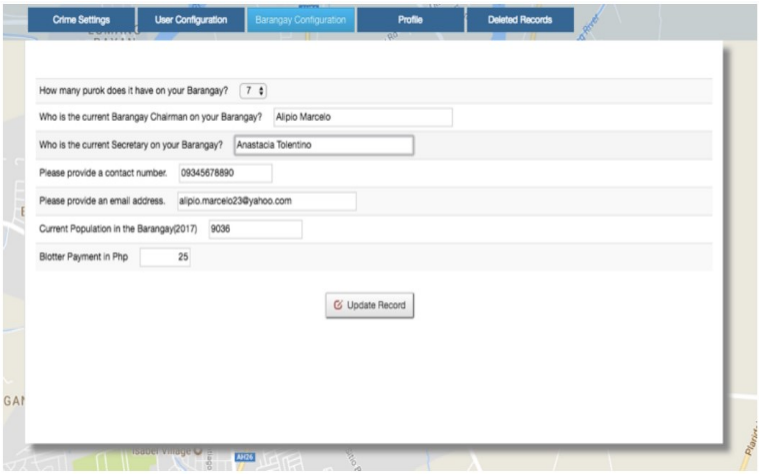


Figure 5. Barangay Configuration

c. Incident Blotter. The system can record incident blotter cases. The administrator can add blotter cases to the system by accessing the Blotter Form option.

Figure 6 shows the blotter form where the basic information of complainant and offender should be filled up correctly.

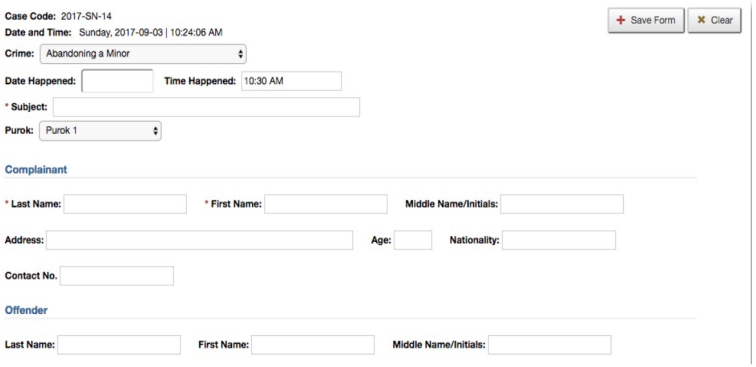


Figure 6. Basic Information

Figure 7 shows the form for entering the narrative of the incident or blotter report. Landmarks on where the incident happened should be included for the administrator to plot the location on the barangay map.

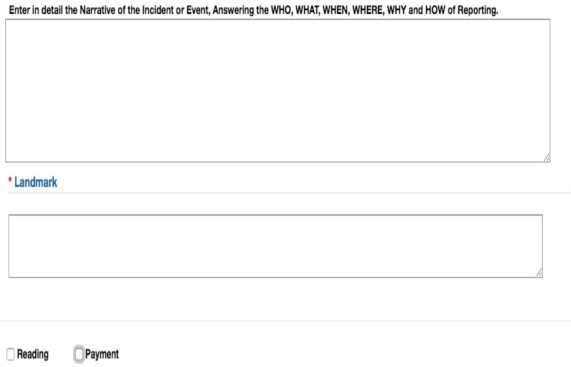


Figure 7. Narrative and Landmark Form

d. Crime Mapping. The system has a crime mapping feature that can tag the crime on the barangay map. Crime mapping allows tagging the blotter on the barangay map. Google map has been embedded on the system so that a map of barangay in Plaridel would be possible. Figure 8 shows the Crime Mapping feature that allows the user to filter by crime type. Map appears with tagged crime. Red marker indicates index crime while green marker is for non-index crime. Crime mapping helps to monitor the crimes happening in the barangay.

Figure 8. Crime Mapping

Figure 9 shows the tagging of blotter or incident on the barangay map.

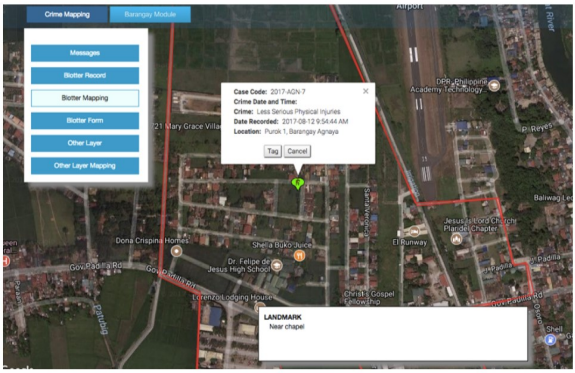
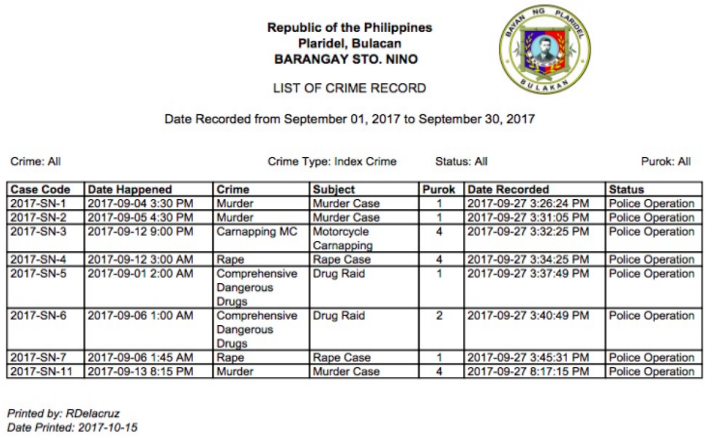


Figure 9. Tagging on Barangay Map

e. Report Generation. The system can generate various reports. The system provides reports that can be viewed in PDF and available for printing. Reports like crime record whether index or non-index crimes, blotter collection, hotspot, offender record and different barangay forms like Certificate to File Action and Patawag.

Figure 10 shows a sample report that the system can be printed.



Republic of the Philippines
Plaridel, Bulacan
BARANGAY STO. NINO

LIST OF CRIME RECORD

Date Recorded from September 01, 2017 to September 30, 2017

Crime: All | Crime Type: Index Crime | Status: All | Purok: All

Case Code	Date Happened	Crime	Subject	Purok	Date Recorded	Status
2017-SN-1	2017-09-04 3:30 PM	Murder	Murder Case	1	2017-09-27 3:26:24 PM	Police Operation
2017-SN-2	2017-09-05 4:30 PM	Murder	Murder Case	1	2017-09-27 3:31:05 PM	Police Operation
2017-SN-3	2017-09-12 9:00 PM	Carnapping MC	Motorcycle Carnapping	4	2017-09-27 3:32:25 PM	Police Operation
2017-SN-4	2017-09-12 3:00 AM	Rape	Rape Case	4	2017-09-27 3:34:25 PM	Police Operation
2017-SN-5	2017-09-01 2:00 AM	Comprehensive Dangerous Drugs	Drug Raid	1	2017-09-27 3:37:49 PM	Police Operation
2017-SN-6	2017-09-06 1:00 AM	Comprehensive Dangerous Drugs	Drug Raid	2	2017-09-27 3:40:49 PM	Police Operation
2017-SN-7	2017-09-06 1:45 AM	Rape	Rape Case	1	2017-09-27 3:45:31 PM	Police Operation
2017-SN-11	2017-09-13 8:15 PM	Murder	Murder Case	4	2017-09-27 8:17:15 PM	Police Operation

Printed by: RDelacruz
Date Printed: 2017-10-15

Figure 10. Report for Crime Record

In the 10 (ten) subjects barangay, determining crime hotspot per purok is not common. Since they are just simply listing down index crime happened in the area, they can only determine which crimes commonly occurred. Index crime according to them is mostly police operation. Say for example, murder happened in the area, the first thing to do is securing the area and call the Police. The barangay secretary then records the crime in the log book and leaves everything to the police.

The system provides the capability for the user to determine crime hotspots per purok. Once loaded the system does the following algorithm: (1) The system counts the index crime recorded per day (2)

Total the index crime recorded happened in a month (3) Then displays the purok with the most number of crimes

Figure 11 shows the map of Plaridel with tagged crimes

Figure 50. Plaridel Map

7 Conclusion

In view of the foregoing findings, the following conclusions were drawn:

1. The study focused on the design and development of the Crime Monitoring Module for enhancing the barangay justice system in the selected barangays in Plaridel, Bulacan. All the problems encountered in relation to peace-and-order transactions, recording and handling of offenses were analyzed to come up with a solution.

2. The significant features of the developed system like crime mapping modules, security module, file maintenance, incident blotter and report generation were proven to be the main requirements to enhance the manual peace-and-order related transactions in barangay.

3. The performance of the newly developed system is proven satisfying and acceptable based on the testing conducted.

8 Recommendations

In light of the findings and conclusion of the study, the following recommendations were drawn.

1. Include all nineteen (19) barangays of Plaridel in the system.
2. Make it possible for the residents to send messages to the barangay officials or allow them to report crime online.
3. Design a particular map where purok of each barangay can be seen.
4. Use density mapping for more artistic presentation of determining hotspot.

References

[1] Bassil, Y., (2012). A Simulation Model for the Waterfall Software Development Life Cycle. *International Journal of Engineering & Technology (iJET),* ISSN: 2049-3444, Vol. 2, No. 5, 2012

[2] Blanchard, B., & Fabrycky, W.(2006) *"Systems Engineering And Analysis",(4th ed.) New Jersey: Prentice Hall. p.31*

[3] Bhasin, H., (2014). *Black Box Testing based on Requirement Analysis and Design Specifications.* International Journal of Computer Applications (0975 – 8887) Volume 87 – No.18.

[4] Boysill, S., (2017). *Governance Of The Barangay Chairpersons In The Municipality Of Ubay Bohol.* International Journal Of Business And Management Studies Vol 9, No 1, 2017 ISSN: 1309-8047

[5] Tupper, C.D.(2015). *Data Organization Practices Retrieved from* https://www.sciencedirect.com/topics/computer-science/waterfall-method

[6] Inflectra (2018). *What are System Requirements Specifications/Software (SRS)? Retrieved from* https://www.inflectra.com/ideas/topic/requirements-definition.aspx

[7] Radack S. (2016). *The System Development Life Cycle (SDLC)/ Retrieved from* http://csrc.nist.gov/publications /nist-bul/april2009_system-development-life-cycle. pdf

[8] Robles, C. (2018).*The Local Government Code Of The Philippines - Chan Robles Virtual Law Library. Retrieved from* http://www.chanrobles.com/localgov3.htm#.XXSiRJMzZBo

[9] Singh, Y.B (2017). *Role of Testing in Phases of SDLC and Quality. Retrieved from* https://pdfs.semanticscholar.org/752b/cf8172b5f033bf872520323366016

[10] Engstrom, S., & Lierud, M., (2006). *Experience Feedback in the Design Phase of Building Projects. Master's Thesis 2006:106. Department of Civil and Environmental Engineering, Division of Structural Engineering*