

Development of an Online Report Management System for Local Government Officials and Residents (e-Reklamo)

Engr. Stanley Glenn E. Bruca

John Ryan Andar

John Calvin Go

David Andrew Guerrero

Matt Angelo Sabater

Abstract This paper details the development and implementation of an online report management system, referred to as “e-Reklamo” system, to help the local government constituents’ express views, disputes, and complaints in the form of online reports reach the authorities. The primary target end-user of this system is the “barangay” – a smallest geographic, administrative, and political unit in the Philippines. Barangay, a small territory of a city or municipality, is governed by a council, locally called as “Sangguniang Barangay.” Its primary function is to plan and implement government policies and programs in the community. With the e-Reklamo, officials can quickly respond to the concerns of its residents, hence providing a more convenient way to send reports and receive immediate feedback or actions. Through the created Android-based mobile application, reports can be created and sent to the admin website for the barangay official to respond. It includes features such as a chat system, locator using Global Positioning System (GPS), and image sending, to assist barangay officials in acquiring more accurate information on reported cases. Application trials and testing, and end-user surveys were conducted to evaluate its functionalities and features. This resulted to an overall satisfactory rating from the respondents on their experience with the mobile application and its admin website.

Keywords: admin website, barangay, mobile application, online reporting, web application

Introduction

A barangay is the smallest and primary administrative and political unit of the local government. Ranges of activities and events happen in the barangay that affects the lives of each citizen. There may be quarrels, squabbles, crimes, or even problems that concern the community in general. According to Mr. Reynaldo Roxas, Chairman¹ of Barangay 757 in the City of Manila, under the administrative district of Sta. Ana, they do not have an online for their residents to report their concerns and problems. Most of which are gathered reports received in their offices or relayed through barangay officials² roaming around the barangay. In case that all barangay officials are engaged in addressing the needs of their constituents, or if they are limited with the number, they will not be able to take reports from the residents. Instead, they will have to wait for the officials to be present simply to report. The employees of the barangay are at times faced with large numbers of reports and a day can simply not be enough for the employees to sort and file all the reports which can stack up. This in turn will make it harder for the barangay to take action with regard to the reports. Some reports may be simple but unsolved because the officials do not know about it yet. Some could be getting worse by the day as it does not take any action making the situation worse than it already is.

Reporting incidents, such as crimes, consumes time and effort and sometimes is ignored (Imus, Magloeo, Soriano, & Olalia, 2018). The inconvenience created by this long and tedious procedure tends to result in the resident turning a blind eye to the concerns in their barangay and often can lead to issues not being resolved. Reports that are ignored can become a big

¹ Chief official of Barangay. Locally referred to as Punong Barangay, as defined in the Local Government Code of the Philippines (cf. Section 387).

² Locally referred to as Lupong Tagapamayapa who serves as community brigades and renders public service and ensure peace and order.

issue down the line and might even affect the entirety of the barangay if not resolved.

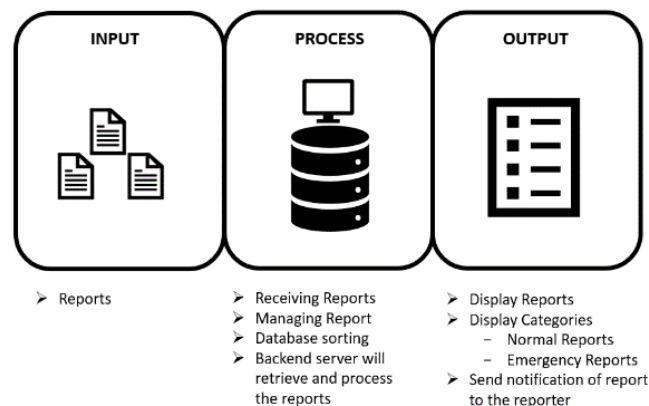
Reporting systems can be a cornerstone to improving the overall condition of an organization.

There are systems created to help track individual incidents and responses over time and helpful for common people, government organizations and different societies (Priya, Srivastava, Islam, & AMIT, 2019). Local Government Units (LGUs) have started to deploy technological solutions to further improve the efficiency and effectiveness of management and delivery of services to its residents (Garcia, 2021). The Butuan City Police Office or BCPO had the iPolice Information System - developed to help the BCPO personnel with solutions to solve the problems they are experiencing and make the response time better. The developed system used Rapid Application Development (RAD) as a development methodology along with Agile Prototyping as an approach. The International Organization for Standardization (ISO) together with the International Electrotechnical Commission (IEC) integrated models so that software quality of such a system can be measured (Bustillo, Patrimonio, & Mateo, 2020). Another application was evaluated and got good results for evaluation as it is very usable for its portability and ability to report crime covertly from a mobile phone (Sakpere, Kayem, & Ndlovu, 2015). A good management reporting system is the foundation of a successful strategy for execution of plans in running an effective local government (Knutson, 2018). People tend to ignore or avoid reporting to the authorities incidents, and the response time of police officers to a report, including verification of report, are the other challenges that (Ogay, Trecenio, & Mairina, 2016) have been enumerated in their research.

For the barangay citizens conveniently create and send incident reports to barangay authorities, e-Reklamo³ has a mobile application to create and send detailed information proposed to offer a faster and time-efficient reporting and filing of incident reports or complaints. The mobile application will categorize the reports received and will help record the reports more easily for the barangay personnel. The mobile application will also help encourage residents to become more responsible residents, hence enabling the barangay to be more alert and ready to respond to a report at the soonest time. Figure 1 illustrates the input, process, and output of the proposed system.

Figure 1

Barangay Reporting System Conceptual Framework



The general objective of this research is to develop a system for the people of the barangay to send reports and barangay officials to manage and respond to the reports. In addition to this, it aims to (1) enable the people of the barangay community to conveniently report issues of the barangay, (2) create a user-friendly system that is accessible to job orders

³ E-Reklamo means electronic complaint reporting. 'Reklamo' is a Filipino word for complaint.

and records, and (3) to provide a time efficient reporting system. While being constrained by these factors, the scope of the application would be one barangay only, when one or more barangay uses the application, the application between two or more barangays cannot communicate, and the handling of the user's data is not guaranteed to be protected even though the user agreed to the terms and agreement.

Table 1

Objective Metrics Description and Scale Measurement

Objectives	Definitions	Metrics	Description	Scale
Convenience	Less effort or difficulty in reporting/receiving reports	Measured through survey like Likert Scale	Excellent	5
			Good	4.00-4.99
			Average	3.00-3.99
			Below Average	2.00-2.99
			Poor	1-1.99
User-friendliness	Easy access and navigation of the system and information are displayed clearly	Measured through survey like Likert Scale	Excellent	5
			Good	4.00-4.99
			Average	3.00-3.99
			Below Average	2.00-2.99
			Poor	1-1.99
Time Efficiency	Time invested to report or execute task in the system	Technical performance specifications testing for improved average time from reporting to receiving	Excellent	< 1 sec
			Good	1-5 sec
			Average	5-20 sec
			Below Average	20 sec - 1 min
			Poor	> 1 min

Table 1 summarizes the objectives and its metrics to be used in evaluating the proposed system. These will be evaluated through a survey via Google Forms which will be sent to the barangay officials and its residents based on a 1 to 5 scale, at 1 being the lowest and 5 being the highest rating, and then getting the average scale for the final rating.

The e-Reklamo would improve response to crimes that happen in the barangay level and constituents will be more willing to take responsibility in reporting issues and pressing matters. With the convenience of this reporting system, people will be more vigilant and barangay officials will be alert so that they can respond quickly to the needs of their barangay. Because reporting incidents in the barangay may involve barangay officials who are not doing their jobs diligently or involved in corruption activities, the personal information of residents who sent reports is ensured to be kept in confidentiality.

Software Application Design

Figure 2

System Block Diagram

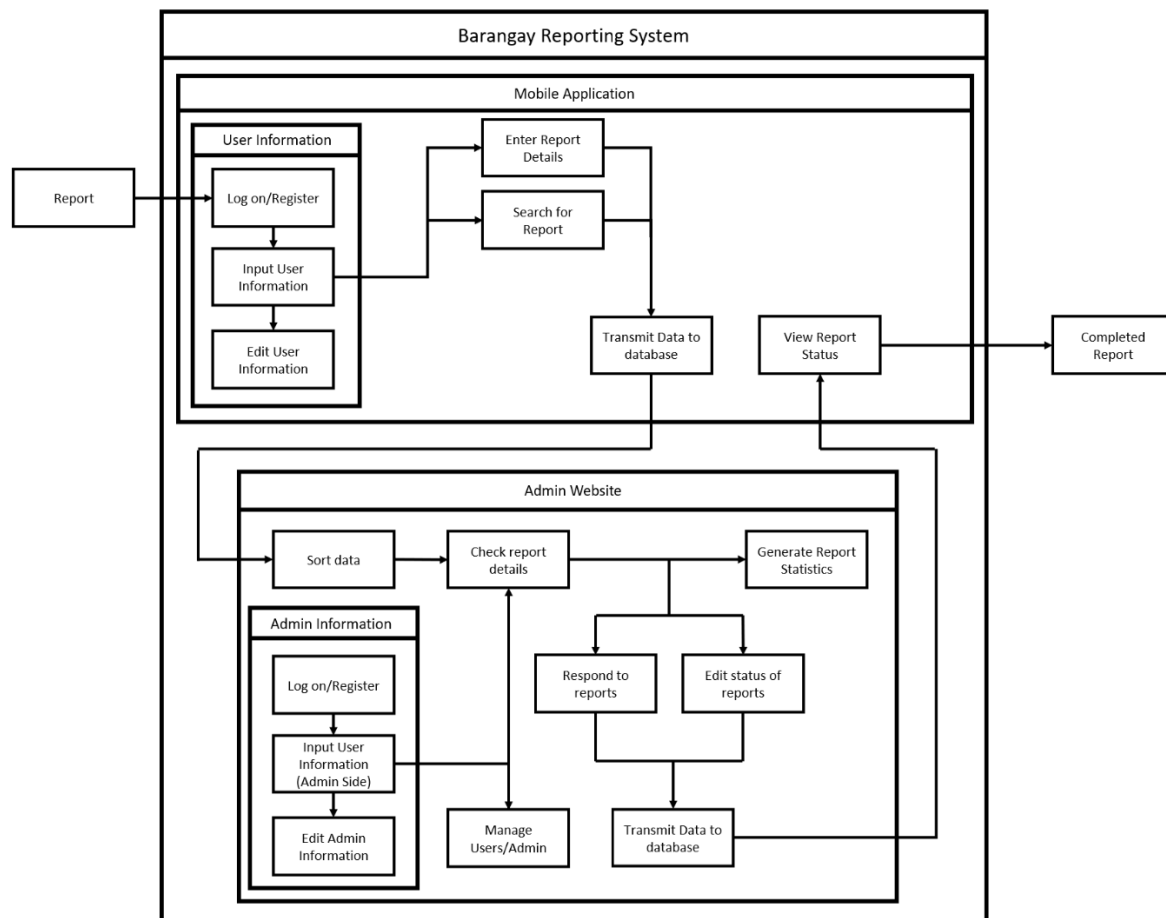


Figure 2 shows the different functions that the barangay reporting system is expected to perform. The system will start by acquiring the report from the user through the application installed in their Android mobile device. This will include the login or registration of the user, input of user details, and editing of user's information on the page. As the report details are entered, data will be transmitted into the database where it will be processed. Report can then be viewed by the user which includes the status of the report and see the updates until the report is completed.

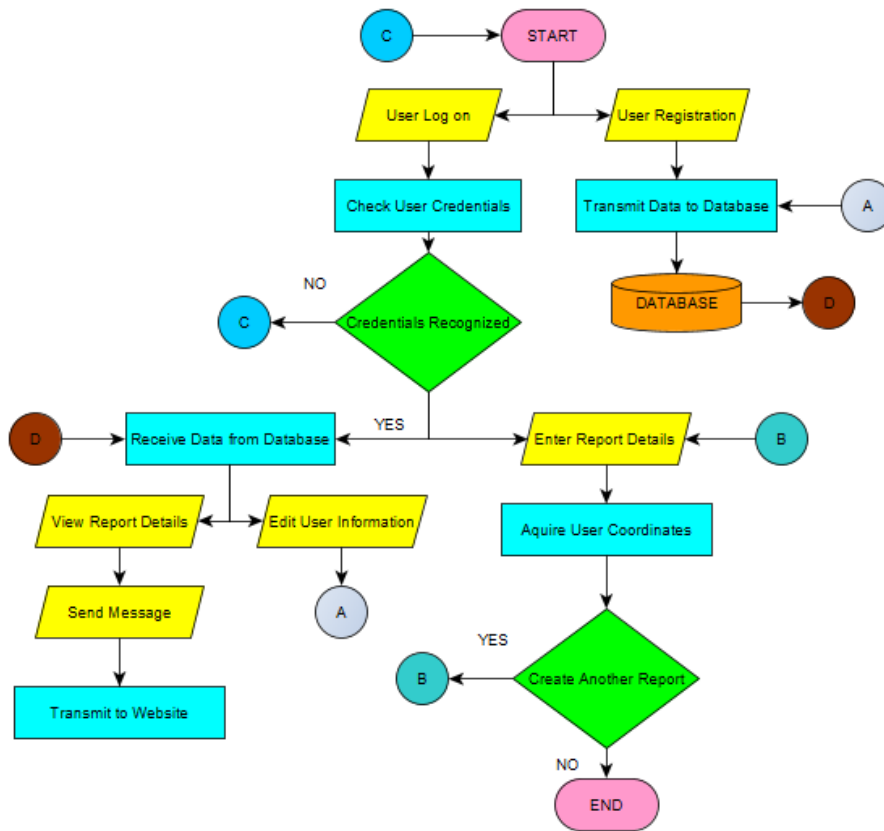
As the data is transmitted, the admin will be able to view the data. The admin is always logged in so that they are available to respond 24/7. The application will sort the data so that the admin can determine the level of priority and assign officials who can respond to the report. With this, the report details are checked, and response is made to the reports and status is updated. Once status is updated, the data is then allowed to be viewed by the user to see whether the report is responded to and completed.

For the mobile side, the user login/registration, input user information, edit user information, enter report details, and search for report functions are to be accomplished by using Android Studio as it has the edge over Visual studio for mobile android application. Conversion of coordinates to exact locations will use Geocoder with HERE as back-up. For the get location function, Location Manager will be used, as it is already built in Android Studio. It is more user- friendly as compared to Fused Location. For the upload photo function, Picasso will be used, since it has a lot of positive feedback, and it is also easier to implement compared to other external image uploading libraries. For the website side, the log on/register, input user

information, edit user information, view reports, check report details, respond to reports, edit status of report, manage users/admins, delete user accounts, and change admin password function are to be accomplished using Visual Studio Code for its support. HTML Graphs were used for generating reports and statistics, while Bootstrap tables for sorting data, for their user-friendliness and easy implementation. To store data in database, cloud-based Firebase was used as it provides a lot of functionality without having to spend a lot of time, effort, and money for its resources. Wi-Fi connection is preferred over mobile networks for faster and more stable internet in transmitting data to the database function.

Figure 3

Mobile Application Flowchart (for residents)



The mobile application process flowchart, as illustrated in Figure 3, starts with user log in or registration. If user registration is selected, it transmits the registered data to the database, while when logs on, the system will check user credentials. If the user's credentials are not recognized it loops back (i.e., connector C) to the start of the system. If it is recognized, the user is given the option to edit user information, enter report details, or view report details. Edit user information allows the user to edit his/her information and it is updated on the database (cf. connectors A, D). Enter report details lets the user input the details of the report they want. After which, the user coordinates are acquired and transmitted to the database which is accessed by the website. The user is then asked if they want to Create Another Report. If yes, it

loops back to the previous choices (i.e., connector B). Otherwise, the system process ends. View report details presents the user their report details and allows the user to send a message to the website for the admin to view.

Figure 4

Website Flowchart (for barangay officials)

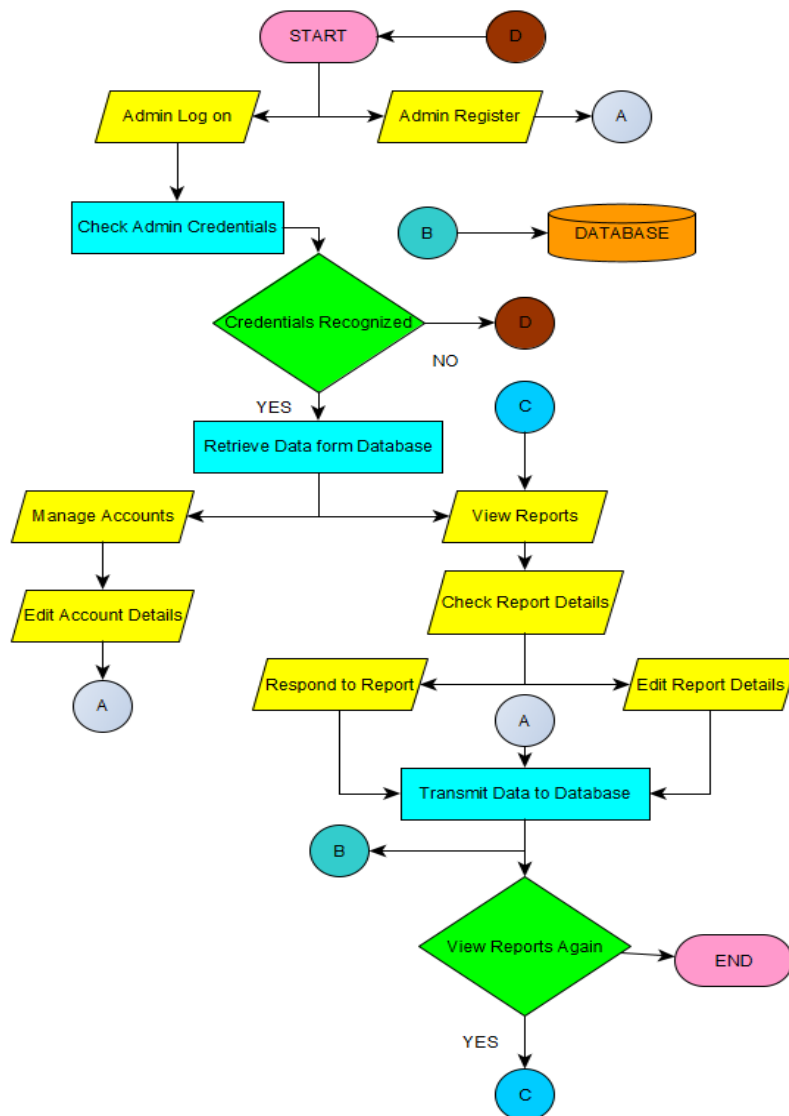
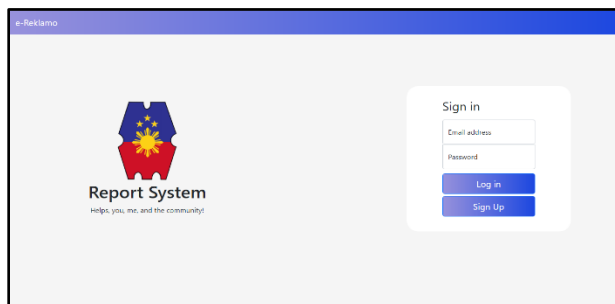


Figure 4 shows the system flowchart of the admin website. The process starts with the admin's choice to either log on or register. If the admin chooses to register a new user account, credentials are transmitted to the database (i.e., connectors A, B) for it to be stored and loops it back to the start of the system. If the admin chooses to log on, the system will check the credentials inputted. If it is not recognized, it will loop back to the start of the system (i.e., connector D) but if it is accepted, the system retrieves the required data from the database and

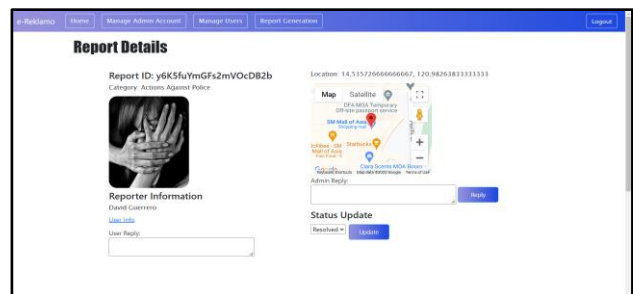
is then presented with two options: manage accounts or view reports. When the manage accounts, option is selected, the admin can edit his/her account details and the changes made are transmitted to the database (i.e., connector A). On the other hand, when the view reports option is selected, functions enable the admin to view the reports in the database and generate a visual and check report details (i.e., connector C). This gives the admin a choice to either respond to the report or edit report details. From there, the system gets the coordinates of the report to be displayed on the map. Both choices transmit data to the database after which the admin is asked whether to view reports again or exit the program.

Figure 5

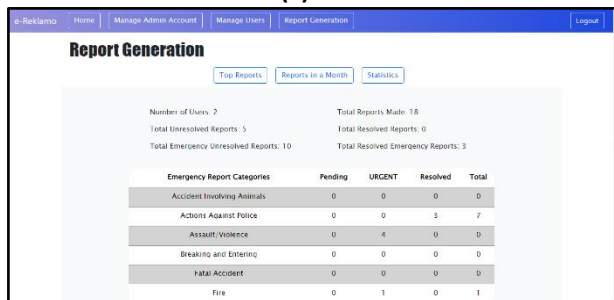
Admin Website User-Interface: a. Login Page, b. Report Details, c. Statistics Page, d. Top Report Page



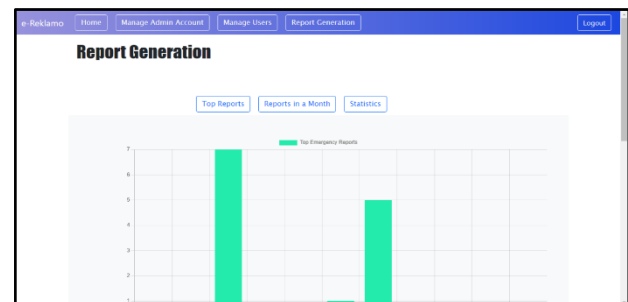
(a)



(b)



(c)

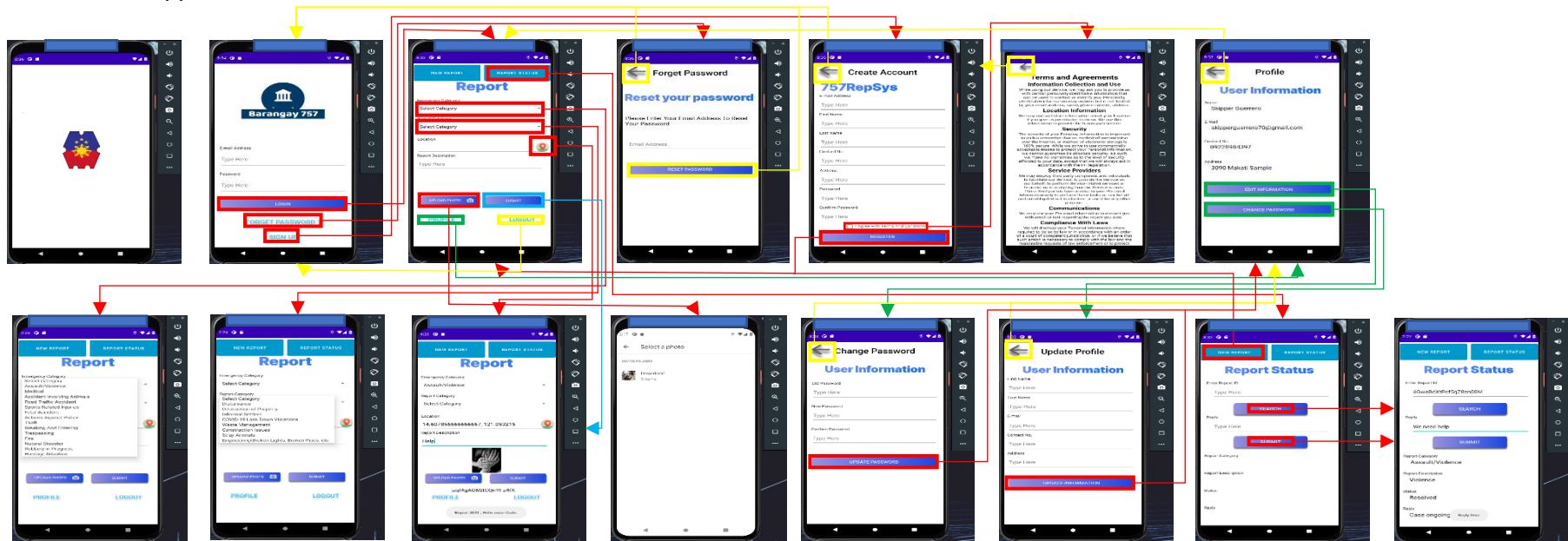


(d)

The user interface included in the admin website are pages for both login and sign-up, a homepage that displays all the reports information that were received from the mobile application presented in tabular and graphical form, and another page to display and manage users. Figure 5 shows screenshots of the login, and report pages.

Shown in Figure 6 are screenshots of the mobile app pages that a user will be able to access depending on which (user-type) module are they in (i.e., admin/official, or resident). The first module that they will see is the home screen of e-Reklamo, and once it is loaded, the user will be directed to the login module where there are several options for them to choose from. The terms and agreements page shows specific details, requirements, and other information about the use of application, including information and laws on the gathering of personal information and recording of the LGU for data recording purposes. The report submission page is classified into either general or emergency. In its location textbox, the resident can opt to either manually input the location or address of concern or click the map pin to use the GPS functionality of the phone which uses their coordinates for their current location. Additionally, the user may add a description of the situation under the report description and likewise attach a picture to support the report. Once the report is submitted, they will get a report code that can be searched in the report status page.

Mobile Application Process Flow



Software Testing and Evaluation

In order to verify and validate both the mobile and web application's functionality according to their design specifications and feature objectives : (1) convenience, (2) user-friendliness, and (3) time efficiency, functional tests were conducted from the residents of four (4) barangays: Barangay 757 of Manila City, Barangays Kasilawan and Bangkal of Makati City, and Barangay 183 of Villamor Air Base in Pasay City, to participate for the mobile application survey, while ten (10) barangay officials of Barangay 757 of Manila City were asked to get their opinions about the convenience and user-friendliness of the admin website, and solicit additional information about ways to improve the usefulness of both the admin website and the mobile application for their residents.

Mobile Application

The end users are given an initial demo of how the app works and are given a brief discussion about its hand-in-hand function with the Firestore database as well as an explanation of what happens to the report sent. After this, they are given the chance to navigate the app on their own before giving out the Google form link for the survey. Initially, most of the residents were happy with the idea of the application, but most of the remarks said while navigating the app is connected to its UI. A lot of the respondents said that the UI is too filled, or the icons and labels are too small. There were a few instances wherein the app was slow - from logging in, acquiring the GPS location, and submitting a report, due to the use of the mobile data service latency. The time execution testing of the mobile application used Google Stopwatch package

initializing on key press and on the end of the code execution. This process was also applied for the login, GPS location, submit report and view report status.

Objective	Number of respondents	Questions	Average Response Rating	System Rating
To enable the people of the barangay community to instantly report issues to the Barangay that is convenient to both the reporter and the recipient of the report	28	Amount of time it took to submit a report	4.14	4.25
		Ease in sending report to the barangay	4.39	
		Usefulness of our application	4.61	
		Performance/stability of e-Reklamo	3.86	
		Sending and Receiving chats regarding your report through the application	4.25	

Table 2

Convenience Evaluation Results

Table 2 shows the five (5) survey questions on convenience with the use of mobile applications. Among the 28 survey respondents, the application got a 4.25 rating with usefulness of the application in sending report with the highest rating of 4.61, and performance stability of the app at a rating of 3.86 as the lowest.

Table 3*User-friendliness Evaluation Results*

<i>Objective</i>	<i>Number of respondents</i>	<i>Questions</i>	<i>Average Response Rating</i>	<i>System Rating</i>
To make the system user-friendly and accessible to job orders and records	28	Clarity of the icons in the application	3.64	3.91
		Clarity of the reporting features of the application	3.96	
		Responsiveness of the application	4.00	
		Feedback of the reporting and report status functions of the application	4.25	
		Navigation and design of the application	3.71	

Table 3 shows the five (5) survey questions on user-friendliness with the use of mobile applications. Among the 28 survey respondents, the application had a relatively lower rating of 3.91 rating with the reporting feedback and status functions with the highest rating of 4.25, and clarity of the icons in the app at a rating of 3.64 as lowest.

Table 4*Time Efficiency Evaluation Results*

Function	Number of Trials	Time Delay Range (ms)	Time Delay Average (ms)	Rating
Login	10	574.9 - 717.7	629.02	Excellent
Sending Reports		1.32 - 3.03	2.11	Excellent
Viewing Report Status		4.56 - 192.4	23.717	Excellent
Acquiring GPS		8.81 - 14.98	11.28	Excellent

Table 4 shows the time efficiency in testing the mobile application on its key features. The average time delay to log-in, sending and viewing reports, and acquiring GPS location is ranging between 4.5 to 5.5 ms, but in one of the test cases, it extended up to 192.4 ms due to

problem in connecting to the cloud database resulting in several request timeouts. Eventually, it was able to connect. The timing component is embedded in the code, specifically in the success or failure listeners of each function.

Based on mobile compatibility testing of the e-Reklamo mobile application, most of the newer and widely used Android operating system supports the functions of the e-Reklamo mobile application as well as communicating with the Firestore database. Phone models used in the testing are: Samsung Galaxy A22, Honor Play, Samsung a55 5G, Samsung a55, Redmi Note 9, Oneplus 7, Vivo V21, Asus Zen phone 6, Huawei Nova 5t, and Pocophone F3.

Admin Website

The evaluation of the admin website involves interview with the barangay officials of Barangay 757, including their chairman. The demonstration includes applications running along on the mobile application and explaining the objectives and purpose of its website to them. It showcased all the modules that the admin website has in tandem with the mobile application for sending sample reports. In the demonstration, the proponents also allowed the barangay officials to navigate the admin website for themselves. Afterwards, the survey linked to the Google forms were shared for them to rate the prototype and share their thoughts regarding the application. There were comments on the benefits of this system being implemented, and it seemed that they had no negative comments other than the absence of a notification system for both the mobile application and the admin website.

The testing for time efficiency for the admin website was done through setting a time at the start of the function to the end of the function within the program. Tested items are for the

login, viewing tables, viewing reports, send reply, and update status. For the viewing tables, list of reports and its details, the timer starts when the user lands on the home page and all the data in the Firebase has successfully printed and displayed on the website. For send reply and update status, the timer starts after the user clicks the button, and the timer ends once the data is sent to the Firestore cloud database.

Table 5

Convenience Evaluation Results

Objective	Number of respondents	Questions	Average Response Rating	System Rating
To enable the people of the barangay community to instantly report issues to the Barangay that is convenient to both the reporter and the recipient of the report	10	Presented Information by the website	5.0	4.96
		Ease in receiving report	5.0	
		Usefulness of our website	4.9	
		Performance/stability of the website	4.9	
		Experience of receiving and sending chats regarding reports through the website	5.0	

In Table 5, the overall system rating for the convenience of the admin website is at 4.96/5.00 resulting in an excellent rating. The system rating was calculated by getting the average of the average response rating of the questions that came from the survey from a total of ten (10) respondents.

Table 6

User-friendliness Evaluation Results

Objective	Number of respondents	Questions	Average Response Rating	System Rating
-----------	-----------------------	-----------	-------------------------	---------------

To make the system user-friendly and accessible to job orders and records	10	Clarity of the icons on the website	5	4.92
		Clarity of report viewing features of the website	5	
		Responsiveness of the website	4.8	
		Feedback of the reporting and report status functions of the website	4.9	
		Navigation and design of the website	4.9	

Table 6 displays the number of respondents for the survey and the average response rating of each question for user-friendliness from the survey. The overall system rating was at 4.92/5.00, which is equivalent to an excellent rating. The system rating was calculated by taking the average response rating of the user-friendliness questions from the survey.

Table 7

Time Efficiency Evaluation Results

Function	Number of Trials	Time Delay Range (ms)	Time Delay Average (ms)	Rating
Logging in	10	1.31 - 1.96	1.53	Excellent
Viewing Tables		168.72 - 271.12	218.04	Excellent
Viewing Report		164.79 - 221.77	205.87	Excellent
Send Reply		0.02 - 0.06	0.03	Excellent
Update Status		0.03 - 0.12	0.06	Excellent

Table 7 shows the time efficiency testing of the admin website in terms of its key features. The testing was done using PLDT internet at speeds around 10 MBPS to 20 MBPS. The Firestore cloud database is 71 MB in total size of all accumulated files. There were fifty (50) reports and their corresponding images. Logging on to the page did not have any issues at an average time delay of 1.53ms.

Summary and Recommendations

The authors were able to create e-Reklamo - a reporting system to service residents in a barangay on sending their concerns, complaints, and situations of emergencies, online. This system enabled quick, convenient, and accessible reporting and receiving of reports to both the residents and its officials. The efficiency of the e-Reklamo has proven its potential to shorten the response time of barangay officials in addressing its residents' concerns, and more importantly in saving lives. This makes it convenient for the residents to report with just a tap on their mobile devices, to have less documentation as the app has a record keeping feature, and to receive instant feedback from the officials in the barangay. The ability of the system to sort the reports received enables easy viewing, assessing, and updating of the status of the reports.

Throughout the project's creation and testing, the authors encountered noticeable issues. Hence, they would like to recommend the following to help improve the system's implementation and deployment. There are areas for improvement in making the mobile application offline ready, making it multi-platform, improving UI placements, using backward compatible plugins to support older versions of Android, and improving the consistency and stability of the application. Should this system be implemented in the future, barangays can become more efficient, officials more effective, and help residents be more proactive citizens of the community.

References

- Bustillo, J. M., Patrimonio, G. A., & Mateo, J. I. (2020, February). Automated Incident Reporting Management System Using Mobile Technology. *International Journal of Innovation, Management and Technology*, 11(1), 18-26. doi:10.18178/ijimt.2020.11.1.870
- Garcia, G. J. (2021, June 5). Designing an Incident Reporting Web Application for Barangay Sinisian, Calaca, Batangas. doi:10.13140/RG.2.2.27253.70884
- Imus, J., Magloeo, E., Soriano, M., & Olalia, R. (2018). Barangay Management Information System (BMIS) for Cities and Municipalities in the Philippines. *International Journal of Computer Applications*, 180(19), 33-36.
- Knutson, K. (2018, October 24). *6 Benefits of a Good Management Reporting System*. Retrieved from Envisio: <https://envisio.com/blog/6-benefits-of-a-good-management-reporting-system/>
- Ocay, A., Trecenio, M., & Mairina, B. (2016). iReport : An Android-Based Real-time Incident Reporting App for PNP Urdaneta. *International Journal of Computer Science and Electronics Engineering (IJCSEE)*, 4(2), 89-94.
- Priya, S., Srivastava, K., Islam, S., & AMIT. (2019, November). Online Crime Reporting System. *International Journal Of Recent Technology and Engineering*, 8(4), 2154-257. doi:10.35940/ijrte.D7734.118419
- Sakpere, A. B., Kayem, A. V., & Ndlovu, T. (2015). A Usable and Secure Crime Reporting System for Technology Resource Constrained Context. *IEEE 29th International Conference on Advanced Information Networking and Applications Workshop* (pp. 424-429). Gwangju, Korea (South): IEEE. doi:10.1109/WAINA.2015.97

ABOUT THE AUTHORS:

Engr. Stanley Glenn E. Brucal is a graduate of BS in Electronics Engineering from Adamson University (2003) and Master of Engineering major in Electronics and Communications Engineering from De La Salle University (2006). He is a Professional Electronics Engineer (PECE), an ASEAN Chartered Professional Engineer (ACPE), ASEAN Engineer (AE), and currently an Associate Professor at NU-Asia Pacific College, School of Engineering. (**Corresponding author:** stanleyb@apc.edu.ph).

John Ryan Andral is currently taking his Bachelor's Degree in Computer Engineering at NU-Asia Pacific College. He is a Senior High School graduate from Pasay City South High School (2019). He created the front-end of the mobile application (E-mail: jcandal@student.apc.edu.ph).

John Calvin Go is currently taking his Bachelor's Degree in Computer Engineering at NU-Asia Pacific College. He is a Senior High School from NU-Asia Pacific College (2019). His task was on website development of the application (E-mail: jbgo@student.apc.edu.ph).

David Andrew Guerrero is currently taking his Bachelor's Degree in Computer Engineering at NU-Asia Pacific College. He is a Senior High School from NU-Asia Pacific College (2019). He developed the back end of the mobile application and the creation of the database (E-mail: dpguerrero@student.apc.edu.ph).

Matt Angelo Sabater is currently taking his Bachelor's Degree in Computer Engineering at NU-Asia Pacific College. He is a Senior High School from NU-Asia Pacific College (2019). He took care of the user interface design of both the mobile and web applications (E-mail: mbsabater@student.apc.edu.ph).