

Automated Incident Reporting Management System Using Mobile Technology

James Cloyd M. Bustillo, Gereao A. Patrimonio, and Jhamie Tetz I. Mateo

Abstract—Aimed to provide a business solution for the Butuan City Police Office (BCPO) to mitigate problems on the veracity and response time of reported incidents, the study developed the *iPolice Information System* for the BCPO personnel and the *iPulis Mobile App* for the citizens of Butuan City. It employed Rapid Application Development (RAD) as a systems development methodology with Agile Prototyping as strategic approach. Empirically, it employed the software quality model of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) also known as the ISO/IEC 9126-1, to measure the level of software quality of the developed systems. The retrieved survey questionnaires from 40 respondents, BCPO personnel and the citizens, had a 100 per cent yield with a 0.96 reliability coefficient. Results of the study reveal that RAD can produce information systems with a highly ISO/IEC 9126-1 software qualities based on means ranging from 4.64 to 4.76. Both sex and type of user do not influence the high level of system software quality assessment but as the software quality general assessment level increases, so as the level of ISO/IEC 9126-1 software quality. The positive outcome of the study led to the recommendation for the deployment of the developed information systems.

Index Terms—Automated incident reporting management, mobile technology, rapid application development, software quality.

I. INTRODUCTION

Information and communications technology (ICT) is a disruptive innovation the human race has developed. It challenged the cultural and individual behavior of mankind [1]. Computerization, the application of ICT in human processes, on the other hand, is transforming the experiences of life and culture penetrating the world with the power of its momentum [2]. These advancement in technology brought impressive impact both in the private and the government sectors [3]. Mobile technology, the application of ICT, is not limited only to smartphone internal sensors to collect data by capturing physical movement (from GPS, gyroscopes and accelerometers), location and transportation mode (GPS), sound, images (camera), social interactions (through location, text and voice) and some physiological parameters [4]. Mobile technology is everywhere: automatic teller machines, banking and finance, smart gadgets, personal and office computing [5].

In 2013, worldwide record of mobile technology

production has reached 6.8 million. Approximately 3.5 million subscriptions were found in the Asia-Pacific region [6]. Likewise, in the 2000s, China and India emerged as the mobile communication titans to watch. Mainland China's sheer market size made it the biggest single global market mobile-supported patterns of migration and urbanization [7] [8], class formations [9], and when the other Chinas — Hong Kong, Macau, Taiwan, plus the wider Chinese diaspora — are added into the mix, it was unsurprising that Chinese mobile cultures alone proved to shift collective understanding of directions in mobile communication. India came into focus in 2013 as another massive Asian market with mobiles at the center of its communication [10].

In 2016, De La Salle University (DLSU) showed research interest on mHealth application development that capitalized on the exponential growth of mobile technologies for the benefit of public health. DLSU implemented a novel smartphone-based development framework for prototyping vision-aware native mHealth applications. They designed and developed a mHealth educational application called the 'Dibdib Advocacy App' to raise breast cancer awareness in the country [11].

The proliferation of mobile technology is evident in the Philippines. Employing ICT, specifically on the mobile technology spectrum, to maintain peace and order and the assurance for a community's public safety is plausible. The fact that the Philippine National Police (PNP) is constantly facing controversies and challenges in carrying its mandate, mobile technology can offer acceptable business solutions. The PNP national leadership made a bold pronouncement to employ modernization in the agency by harnessing the bottomless benefits of ICT. Technology infrastructures are now deployed but are still in its minimum because of budgetary constraints. The Butuan City Police Office (BCPO) is no exemption to the financially challenged predicament of the PNP.

The study seeks to bridge the gap between the mandate of the BCPO and the efficiency and effectiveness in performing such mandate. Harnessing the benefits of mobile technology, the study is geared towards the development of a business solution for an automated incident reporting management system. The empirical component aims to validate the software quality of the developed system along with the establishment of correlation of responses of the type of users and between the sex of the respondents.

II. SYSTEM SCOPE

The automated incident reporting management system is a web-based two-tier application system – BCPO system and the citizen mobile app that covers the reporting incidents

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James Cloyd M. Bustillo is with ACLC College of Butuan Inc., Philippines (e-mail: bustillo.jamescloyd@gmail.com).
Gereao Alviola Patrimonio is with Silliman University, Philippines.
Jhamie Tetz Infante-Mateo is with Commission on Higher Education Region, Philippines.

handled by the BCPO. Specifically, the developed system application handled three major business processes in the BCPO:

A. The User Maintenance Module

This module manages all types of users, definition of police sub-stations and scheduling and assignment of policemen in the BCPO organization. It underscores populating the database of the system with the following key points:

- 1) App Users Profiling. The process to take to populate the database containing users who downloaded the App from Google App Store and use it for incident reporting.
- 2) App User Authentication Procedure. The processes to be undertaken both by BCPO and the citizenry that validates the identity of the App User applying to be part of the system.
- 3) Police Users Profiling. The process to be undertaken inclusive of populating and maintenance of the databases that handle the police information system, log-in profile along with access rights among other pertinent information about individual policeman of the BCPO organization.
- 4) Police Sub-station Profiling. The process that populates and maintains the database of established police sub-station situated in the barangays of Butuan City.
- 5) Duty Rotation Planning. The process to be taken when the BCPO conducts duty assignment plotting, location and schedule, to the different police sub-stations of Butuan City.

B. The Incident Reporting Module

This module handles all incoming incident reports from the community. The business processes focused in the following key points:

- 1) Mobile App. An application platform that is used by the system to capture the incident, stamped with the time, date and coordinates of submission. Installed in the devices of the citizenry, the user who sends an incident report is a “bona fide member” of the system after going through the validation and authentication process done in module number one, hence, incidents reported come from “authorized” user.
- 2) Police Station Desk Segment. The business process that handles all incoming incident reports. It operates by checking the received incident report as to the sender through the system’s “bona fide members” profile database. Once validated, using the coordinates received from the sender, the system will forward to the nearest identified police sub-station, as identified by the system, for
- 3) appropriate action. Likewise, the sender shall be informed of the status or remarks of the reported incident after appropriate action is undertaken.
- 4) Police Sub-Station Desk Segment. As the recipient of a validated incident report from the main station, this segment informs the police on-duty in the concerned sub-station and performs appropriate action. A status or remark will be indicated in the incident report to conclude the process. The status or

remark is thrown back to the main station in compliance of the reported incident and shall serve as basis for further appropriate action in case the incident report escalates into an alarming proportion.

C. The Enterprise Reporting Module

Compliant to the requirements of the BCPO, this reporting management module covers two key points:

- 1) Data visualization. As the primary goal is to communicate information clearly through the use of information graphics, this category will present a pie graph contains verified information from all reported incidents, it also provides visualization of all barangays which has records of incidents. The generated report will assist the BCPO officers simplify the reported incidents through a graphics presentation of data for better Understanding.
- 2) Interactive Querying. The process includes summarizing the reported incidents as verified by the police officer. These data may include, but not limited to, history of incidents report per barangay and history of incidents by date. This key would help the BCPO to be efficient in carrying out its mandate. It will also help the Office manage the data that have been collected and to monitor all information.

III. RELATED LITERATURE

A. Theoretical Framework

Fig. 1 is the depiction of a multi-dimensional framework of theories used as the backbone of the study.

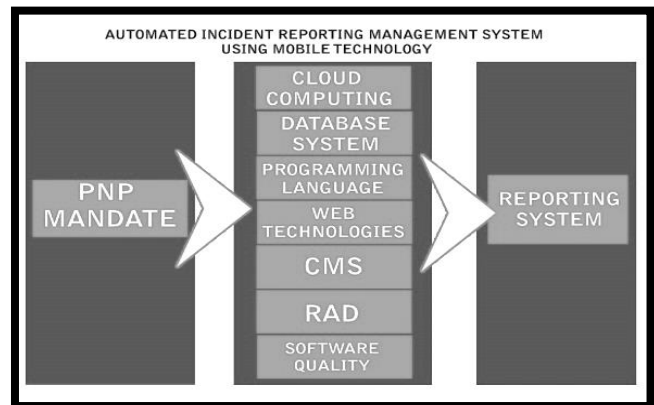


Fig. 1. The theoretical framework of the study.

B. The PNP Mandate

In the law enforcement sector of the government, particularly the Philippine National Police, that was established by virtue of the Republic Act 6975 or otherwise known as the Department of the Interior and Local Government Act of 1990, and was given the following powers and functions as per Section 24 of the said Republic Act, viz; (a) Enforce all laws and ordinances relative to the protection of lives and properties; (b) Maintain peace and order and take all necessary steps to ensure public safety; (c) Investigate and prevent crimes, effect the arrest of criminal offenders, bring offenders to justice and assist in their

prosecution; (d) Exercise the general powers to make arrest, search and seizure in accordance with the Constitution and pertinent laws; (e) Detain an arrested person for a period not beyond what is prescribed by law, informing the person so detained of all his rights under the Constitution; (f) Issue licenses for the possession of firearms and explosives in accordance with law; (g) Supervise and control the training and operations of security agencies and issue licenses to operate security agencies, and to security guards and private detectives, for the practice of their professions; and (h) Perform such other duties and exercise all other functions as may be provided by law [12].

PNP Butuan City is bound to follow and perform the mandated system of reporting and responding to crimes. According to SPO2 Allan Eda, member of the SWAT and operational team of PNP Butuan City, offices implemented the hotline 117 and 116. For incidents reporting, citizens can text or call to these hotline numbers or make a personal report to the police station. The current manual system is inefficient based on the veracity of the report. An incident report is processed only with the basic “5W” (Who, Where, What, When, and Why) and “1H” (How) method and has an average of 20% prank calls and incorrect information an incident [13].

C. Cloud Computing

“Cloud computing is a practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer. It is an information technology (IT) paradigm that enables ubiquitous access to shared pools of configurable system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet. Cloud computing relies on sharing of resources to achieve coherence and economy of scale, similar to utility” [14].

Third-party clouds enable organizations to focus on their core businesses instead of expending resources on computer infrastructure and maintenance. Advocates note that cloud computing allows companies to avoid or minimize up-front IT infrastructure costs [15].

This study used the Google App Store to host the developed app for the citizens’ use.

D. Database Systems

As a collection of studies, database theory evolves in the context of relational modelling of data. Data modelling is an abstraction of data that assists understanding, and promotes handling and manipulation. It is comprised of three dimensions: (a) Relational database stored in tabular form; (b) Hierarchical database organized in a tree-structure; and (c) Network database stored as graphs representing relationships between and among objects. Thus, a database is defined as a repository of intelligent material designed to support efficient storage, retrieval, and maintenance [16].

Database Management System (DBMS) are programs that implement relational modeling of information into a computer system whose goal is to assist in maintaining and utilizing a large collection of data, and the need for such system, as well as their use. It manages data with a vigorous and efficient method [17].

The study used an open-source system called MySQL to

implement the database component of the developed system.

E. Programming Language

“A programming language is a set of well-formed rules for instructing a computer to execute specific tasks. Each programming language has a single set of keywords and syntax for creating program instructions” [18].

This study used python, and node.js as programming languages to code the different business processes of the system.

F. Web Technologies

This refers to the sum total of all technologies that drive the functional services of the Internet called the World Wide Web (www). Web technologies is classified into two categories: Back-end technologies cover the details of construction, operation, and tools that support the publication of a website, including hardware requirements. Front-end technologies cover the aspect how users are able to view websites. Simply put, the quality of the front-end is highly dependent on how the back-end is defined, constructed, and managed.

Hardware requirements in the back-end entail the use of the server computer equipped with networking technology that enables it to broadcast and communicate with other computer around the globe. The software requirement starts with a network operating system that mediates the hardware component requests [19].

This study sought to use open source third party programs to realize the web-based nature of the system: Python (flask) version 3.5+, cordova version 7+, XAMPP (XAMPP-win32 or xampp V.1.8.3, navicate version 10.1.8 enterprise).

G. Content Management Systems (CMS)

CMS are software applications or set of related programs that are used to create and manage digital content. CMSes are typically used for enterprise content management (ECM) and web content management (WCM). An ECM facilitates collaboration in the workplace by integrating document management, digital asset management and records retention functionalities, and providing end users with role-based access to the organization's digital assets. A WCM facilitates collaborative authoring for websites. ECM software often includes a WCM publishing functionality, but ECM webpages typically remain behind the organization's firewall [20].

The study used, as CMS of the developed system, a web content management.

H. Rapid Application Development (RAD)

As software development methodology, RAD adheres to the systems development life cycle but employing strategies, tools, and practices that reduce the development time without sacrificing the quality of the system developed.

Generally, RAD has three objectives in its framework. It aims to: (a) ensure timely and speedy delivery of a working application; (b) aid the customer to properly identify the requirements, and (c) deliver the customer’s requirements with accuracy using prototyping and iterations [21].

I. Software Quality

Quality of a software product is complex to measure

because it involves moving parts like networks, security, operating systems, varying processors in computers among others. Added to it is the unpredictable behaviors of people who use the product [22].

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) have minted a worldwide standardization model that measures the quality of software products called the ISO/IEC 9126. The model described software quality as a function of internal and external qualities, and the quality in use. The boundary that covers the internal and external qualities cover the variables for functionality, reliability, usability, efficiency, maintainability, and portability. Effectiveness, productivity, safety, and satisfaction are the variables that make up for the quality in use [23].

IV. THE SYSTEM DEVELOPMENT

The Automated Incident Reporting Management System Using Mobile Technology was developed adhering to the tenets in systems development life cycle (SDLC). As a methodology, it employed RAD with prototyping and iterative and incremental strategies. A series of RAD workshops were conducted to the BCPO and selected citizens in Butuan City to capture, verify, and validate user requirements. The RAD workshops resulted in shortened planning and problem analysis phases. It also facilitated the design and coding because of the transparency of systems requirements and the shortened verification and validation procedures from the users.

A. *The Functional User Requirements*

Functional user requirements are the declaration of the system features along with the system's behavior when introduced to inputs and situations [24]. The series of RAD workshops have captured these features for the developed system. The Automated Incident Reporting Management System shall be able to:

- 1) enroll all policemen assigned in the police station and its sub-stations in Butuan City;
- 2) download the app from Google App Market;
- 3) register as a legitimate citizen user of the system following the authentication procedure;
- 4) allow to make a duty rotation plan for the policemen in Butuan City;
- 5) allow to send incident reports (developed Google App) from the citizens' mobile gadgets to the BCPO;
- 6) assure that the received incident reports are free from malicious codes and shall not infect the BCPO system and its databases;
- 7) accept incident reports from the citizens of Butuan City using their mobile gadgets with the validated information that can facilitate appropriate response and dispatching to the concerned police sub-station;
- 8) allow citizens to receive the appropriate response done by the BCPO from the reported incident; and
- 9) generate reports based on the mandates of the BCPO for the purpose of information dissemination and aid in decision-making.

B. *The Non-functional User Requirements*

The non-functional user requirements describe the inclusive performance of a system that has to be developed. It outlines the system's technical architecture based on the identified constraints [25]. Issues in the operationalization of the Automated Incident Reporting Management System have sprung from the series of RAD workshops. The issues were refined, analyzed and calibrated which resulted in definition of the non-functional user requirements. The Automated Incident Reporting Management System must be:

- 1) accessible by all legitimate registered users under no specific operating system platform and computer machine or mobile gadget assignment;
- 2) accessible by all legitimate registered users without specifying the brand of browser and mobile gadget; and
- 3) accessible by any printer in the work environment of legitimate registered users.

C. *The Adapted Prototyping Process Model*

The agile software development model was employed in implementing RAD as a system development methodology. The agile scrum process, first used by Jeff Sutherland in 1993, was an offshoot from the analogy used by Takeuchi and Nonaka in their study in 1986 published in the Harvard Business Review. The model can address the changing requirement issues from users. It puts emphasis on catering and allowing changes as the consultation progresses in the RAD workshops.

On the outset, the strategy elicits the feeling of system ownership among the system users when they get to be involved in the design and implementation of system interfaces and the processes [24] Fig. 2 elucidates the prototyping model used in the development of the Automated Incident Reporting Management System.

D. *Designing and Implementing the Automated Incident Reporting Management System*

After observing all protocols, a Technical Working Group (TWG) was created by the BCPO during the initiation, planning, and requirements analysis phases. The TWG was tasked to take lead in the series of RAD workshops with the BCPO along with the validation, verification, and testing procedures of the developed system. As a major deliverable prior to the design and implementation phases, Fig. 2 depicts the general work breakdown structure for the Automated Incident Reporting Management System that uses mobile technology.

V. THE SYSTEM

The developed automated incident reporting management system that uses mobile technology comes in two packages: (a) the *iPolice* is web-based intended for use in the BCPO, and (b) the *iPulis* ("pulis" as the vernacular term for police) is the mobile app downloadable at the Google App Market intended for use by the citizens of Butuan City for incident reporting.

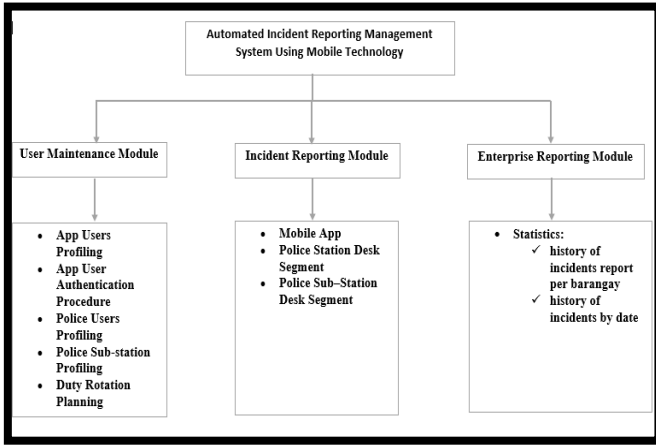


Fig. 2. The general work breakdown structure of the system.

Both systems were developed with the adherence of high user involvement as mandated in the tenets of RAD. Fig. 3 and Fig. 4 show the screenshots of the site map plan for both systems – the *iPolice* and *iPulis*.

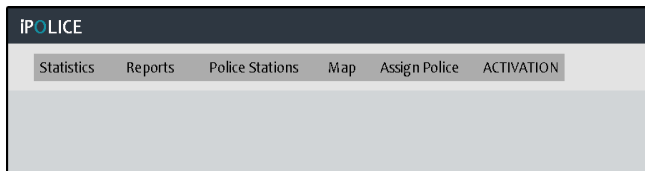


Fig. 3. The *iPolice* site map for the BCPO.

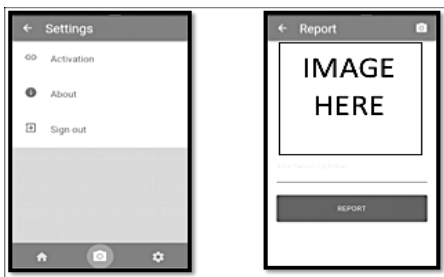


Fig. 4. The *iPulis* app site map of the user citizens.

A. The Login Mechanism for Security Control

To ensure the system and data integrity, the login mechanism is employed to validate only legitimate users of the system. Fig. 5 shows the implementation of the login mechanism of the *iPolice* system.

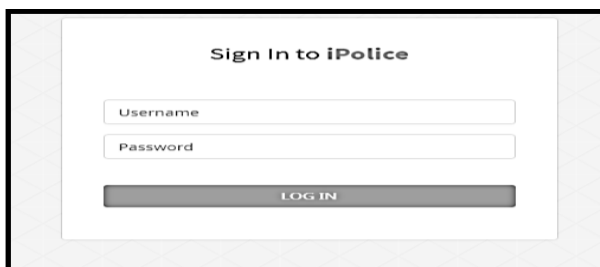


Fig. 5. The *iPolice* user login mechanism.

B. The User Maintenance Module

This module is used to populate and maintain tables in the database that makes the system usable. This covers the profile of users, assignments, and scheduling of policemen to stations, the legitimate users – police personnel and citizens of Butuan City, definition of police stations.

Fig. 6 shows as part of security, registration is required to access the application. The registration form will run before the main menu, the App user must fill-up the assigned field and username and password in the login form in order to open the application and use it.

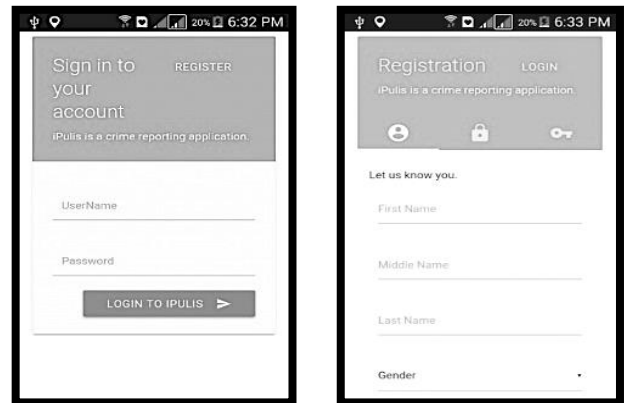


Fig. 6. The mobile app user registration mechanism.

Fig. 7 shows the process to be undertaken inclusive of populating and maintenance of the databases that handle the police information system.

C. The Incident Reporting Module

This module involves the communication between the *iPulis* (app citizen users) and the *iPolice* (the BCPO users). Stamped with the date, time, and coordinates of the captured incident from the mobile gadget of the app citizen user, the transmitted information is received by the *iPolice* system in the BCPO. The system identifies the location of the incident and pushes this as notice of incident for appropriate action to the nearest police substation. The app citizen user receives a status report after responding to the reported incident.

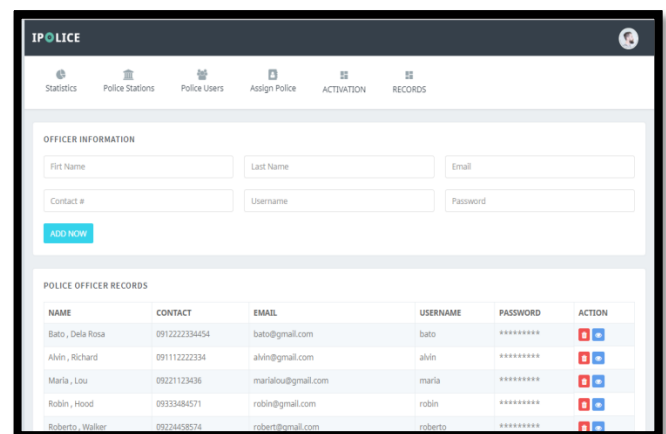


Fig. 7. The police users' profiling screenshot.

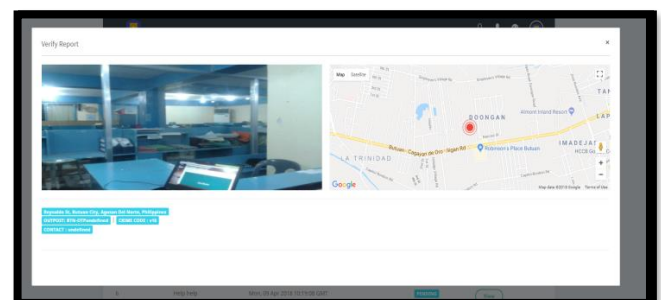


Fig. 8. The incident report screenshot.

Fig. 8 shows the implementation of the reported incident procedure from the mobile app sent to the iPolice system. The system displays the record of the incident with the location and image of the incident.

D. The Sample Reports

Reports generated by the iPolice can be used to assist the BCPO in the information dissemination through its mandated reports and the decision-making of BCPO planning endeavors.

The Fig. 9 shows a sample list of reported incidents with a corresponding date and time.

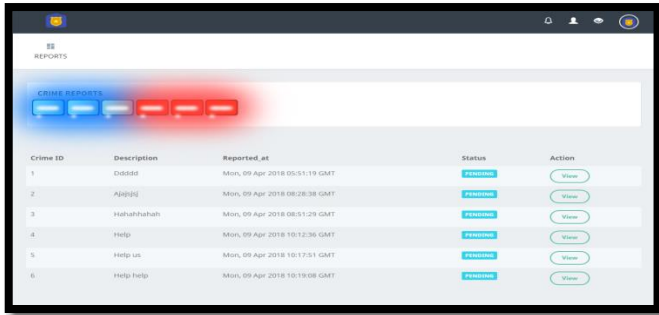


Fig. 9. Screenshot of a sample list of incident report.

VI. THE SYSTEM EVALUATION RESULTS

The researcher distributed survey questionnaire for the automated incident reporting management system’s software quality survey. Two separate schedules were conducted for the iPolice Information System and the iPulis Mobile App last March 23 and 24, 2018 respectively. The March 23 was intended for the 30 BCPO personnel while the March 24 was given to the 25 citizens as volunteers consisted of college students, co-workers, and friends in the academe and some representatives from the barangay level communities. A total of forty (40) users, or 73 percent in both systems, 20 for the iPolice Information System and 20 for the iPulis Mobile App, volunteered to be respondents. On March 28, 2018, 40 duly filled-up survey questionnaires adapted from the ISO/IEC 9126-1 software quality model were collected. The survey obtained a 100 percent yield.

A. Software Quality Assessment Levels

Table I elucidates the results of two statistical treatment done on the tabulated results of the survey for the software quality assessment in both the iPolice Information System and the iPulis Mobile App. The Validation Statistics shows, applying the Cronbach’s alpha reliability coefficient to check on the internal consistency of the items attributing to the constructs of the software quality, a reliability coefficient ranging from 0.76 to 0.91 from the five scales. According to Nunnally, as cited by Patrimonio [25], a reliability coefficient greater than 0.60 is an acceptable value to prove for the reliability of a survey questionnaire as the research instrument used. Hence, when all scales are combined to prove for the overall reliability of the survey questionnaire, overall software quality assessment, the whopping 0.96 reliability coefficient proves it all to be reliable as research instrument.

TABLE I: THE VALIDATION AND DESCRIPTIVE STATISTICS OF THE SOFTWARE QUALITY ASSESSMENT LEVEL OF THE IPOLICE INFORMATION SYSTEM AND THE IPULIS MOBILE APP

Scales	Items	Valid Cases	Validation Statistics	Descriptive Statistics		Interpretation
			Alpha Reliability	Mean	sd	
A. Functionality	3	40	0.91	4.64	1.37	Extremely Agree
B. Reliability	3	40	0.90	4.64	1.35	Extremely Agree
C. Usability	7	40	0.85	4.69	2.42	Extremely Agree
D. Efficiency	4	40	0.83	4.76	1.51	Extremely Agree
E. Security	2	40	0.76	4.70	0.81	Extremely Agree
F. Overall Software Quality Assessment (Scales A – E)	19	40	0.96	4.69	1.49	Extremely Agree
General assessment as a valuable business solution for BCPO	1	40	-	4.88	0.34	Extremely Agree

The Descriptive Statistics, employing weighted means, show the software quality assessment central tendencies. All five attributes of software quality – Functionality, Reliability, Usability, Efficiency, and Security, individually received a weighted mean ranging from 4.64 to 4.70. The verbal interpretation “Extremely Agree” describes the aforesaid range. The aggregate mean of 4.69 for all attributes can similarly also be interpreted as “Extremely Agree.” A concluding item to describe the overall experience of using both systems – iPolice Information System and iPulis Mobile App, garnered a weighted mean of 4.88 and can be interpreted as “Extremely Agree.”

B. Relationship of Variables

Table II reveals, using the chi-square and spearman correlation statistics to establish a significant association of variables, that when cross-tabulating the overall assessment as experienced by the respondents (as point A) on the Automated Incident Reporting Management System that uses mobile technology, will establish interdependencies of responses between two independent variables.

TABLE II: TEST OF RELATIONSHIPS RESULTS

Variables (A * B Crosstabulation)	Pearson Chi-Square	Spearman Correlation	p-value	Remarks
B ₁ - Sex (M and F)	1.429	0.728	0.232	Not Significant
B ₂ - Type of User (BCPO and Citizens)	0.229	0.076	0.633	Not Significant
B ₃ - Overall Software Quality Assessment	35.429	0.581	0.003	Significant

* alpha = 0.05

At 95 percent confidence level, results of statistical treatment to establish significant association lead to the following interpretation:

- 1) that the general level of assessment on the software quality of the Automated Incident Reporting Management System that uses mobile technology is significantly not influenced by the sex, male or female, of respondents;
- 2) that the general level of assessment on the software quality of the Automated Incident Reporting Management System that uses mobile technology is significantly not influenced by the user classification, BCPO personnel or citizens, of respondents;
- 3) that the general level of assessment on the software quality of the Automated Incident Reporting

Management System that uses mobile technology is significantly associated with the aggregate means of the software quality attributes. Furthermore, it can also be said that as the general level of assessment, as experienced by the users in using the aforesaid system, gets higher, so as the individual attributes of software quality.

VII. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

Relevant RAD methodology. This study found that RAD works as a methodology in developing information systems. The series of RAD workshops have shortened the problem analysis and the identification of requirements phases. The agile prototyping fostered the efficiency and effectiveness of the verification, validation, and testing in the development phase. To sum it up, the high degree of user involvement, facilitated the reduction of development time without sacrificing software quality.

Timely and accurate Software Quality business model. The adapted software quality business model, the ISO/IEC 9126-1, helped in estimating the level of software quality of the developed system thereby facilitating the BCPO in its acceptance and implementation of the Automated Incident Reporting Management Systems Using Mobile Technology. The software quality survey questionnaire implemented the 5-point Likert's scaling system to capture respondents' agreement of statements. It uses the following scaling calibration scheme: 5 for extremely agree (or 76 – 100 percent in agreement); 4 for moderately agree (or 51 – 75 percent in agreement); 3 for somewhat agree (or 26 – 50 percent in agreement); 2 for slightly agree (or 1 – 25 percent in agreement); 1 for disagree (or completely no agreement to the statement).

Functional, reliable, usable, efficient and secure iPolice Information System and iPulis Mobile App. The survey to establish the software quality of the aforesaid system set the record that both the iPolice Information System and the iPulis Mobile App are valuable business solutions for the BCPO. This conclusion is anchored on the findings, based on the ISO/IEC 9126-1 business model and by way of implication, that the developed and tested Automated Incident Reporting Management System is highly functional, highly reliable, highly usable, highly efficient, and highly secured as evidenced in the computed means of 4.64, 4.64, 4.69, 4.76, and 4.70 respectively. Relative to the high level of software quality as evidenced in the aggregate software quality mean of 4.69, consistently, the developed Automated Incident Reporting Management Systems was regarded as a valuable business solution for the BCPO as evidenced in a high level of general assessment with a mean of 4.88.

Confident association of perceptions. At 95 percent level of confidence, the captured perception of the software quality of the systems from the users is with certainty when associated with the respondents' demography. Conclusively, the extremely high software quality levels of the iPolice Information System and iPulis Mobile App has nothing to do with the sex (male or female) or the type of user (BCPO personnel or citizens). But on the contrary, the users of the

two systems revealed consistency in their perception that is when the general assessment of the software quality levels increases, so as the levels of the individual constructs of software quality defined by ISO/IEC 9126-1. By way of implication, since the general assessment of software quality levels on the two systems are extremely high, therefore, in the lens of the ISO/IEC 9126-1, the overall software quality of the Automated Incident Reporting Management Systems that uses mobile technology is extremely high.

B. Recommendations

The study was geared towards providing a business solution for the BCPO to mitigate the problems confronted by the policemen of Butuan City. Likewise, this study is also aimed at bridging the gap between the mandate of the BCPO and the efficiency and effectiveness in performing such mandate by harnessing the benefits of mobile technology.

Results of the study point to the recommendation of incorporating and adopting iPolice Information System and iPulis Mobile App for deployment and actual use under the following BCPO policy:

- 1) that the BCPO leadership shall document all experiences of the main police stations down to the sub-stations on their use of the iPolice Information System regarding the software quality such as functionality, reliability, usability, efficiency, and security;
- 2) that the BCPO leadership shall establish a documentation system to capture experiences of the citizens on the use of the iPulis Mobile App on the software quality such as functionality, reliability, usability, efficiency, and security;
- 3) that the BCPO leadership shall establish benchmark policy and endeavors with other PNP in the country that have earlier adopted a similar automated system;
- 4) for future innovations of an Automated Incident Reporting Management Systems Using Mobile Technology, shall consider features that can a) strengthen veracity of reported photo by employing image processing analytics, b) include analytics for missing persons and most wanted criminals, and c) centralize reliable incident reporting system by deploying the aforesaid systems on a regional scale for the CARAGA region.

CONFLICT OF INTEREST

There was no conflict of interest between the authors.

AUTHOR CONTRIBUTIONS

James Cloyd (J. C) and Jhamie Tetz (J. T) comprehended of the presented idea during the proposal stage. J. C designed the conceptual and theoretical framework of the study and performed the computation. Gereao Patrimonio (G. P) verified the analytical methods and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

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James Cloyd M. Bustillo was born in Iligan City, Philippines. He took his bachelor of science in information technology and finished his M.S in information technology at Jose Rizal Memorial State University, Dapitan City in 2018. He has been teaching in ACLC College of Butuan Inc. and also is a head of Research and Innovation Department of Information Technology.

Mr. Bustillo is an active member of the Philippine Society of Information Technology Educators (PSITE) of CARAGA. He is a certified security sentinel and certified vulnerability assessor.



Gereo Alviola Patrimonio was born in Dumaguete City, Philippines. He holds two baccalaureate degrees, the first one is the bachelor of science in computer science and the second one is the bachelor of science in nursing. He finished the master's in information systems at Silliman University in Dumaguete City in 2015 and currently pursuing in the same university the degree doctor of philosophy in education major in research and evaluation.

As an associate professor at the Jose Rizal Memorial State University (JRMSU) in Dapitan City, he is concurrently the program chairperson for the bachelor of science in information systems (bsis) and the master of science in information system (ms-it) degree programs. As the director of FabLab Dapitan in JRMSU, his research interests include elearning, educational assessment, startups, innovation, and prototyping.

Prof. Patrimonio is an active member of the Philippine Society of Information Technology Educators (PSITE) of Region 9. He is the founder of the center for digital transformation of business solutions, and is a digital incubator in JRMSU main campus, serving the micro, small, and medium enterprises of the province as extension program of the bsis degree program. Prof. Patrimonio is also the prime mover for the youth civic action movement in the campus as integrated in the general education course "science, technology and society" that holds students' competition of solutions to identified problems in the community.



Jhamie Tetz Infante-Mateo was born in San Mateo Isabela. She was a 6 – time leadership awardee, 6 – time performing arts awardee, 2 – time loyalty awardee, best in English awardee and received the coveted scholarship award for a 4 – year degree/course from her Alma Mater, the La Salette education award. She graduated as a valedictorian during her elementary years and 1st honorable mention during her secondary education at La Salette

of San Mateo, Isabela.

She was also a meritorious citation awardee for her baccalaureate degree, bachelor of science in computer and information science in 2000 at

University of La Salette, Santiago City. From the same university, she graduated with a degree of master of science in information technology in 2003 and in 2008, she graduated as a doctor in management, majoring in general management at Liceo de Cagayan University, Cagayan de Oro City.

Currently, she is a regional supervisor at the Commission on Higher Education Region – IX in-charged with the ICT programs. According to her, learning is a continuous process of acquiring and processing human experiences to create a meaningful purpose of one's existence in the organization, which can be done through self-paced or blended learning approach. To prove it, in last December 2018, she obtained her masters degree in development management at the Development Academy of the Philippines, while being a visiting lecturer at the Jose Rizal Memorial State University and at the same time a member of the national gender resource pool of the Philippine Commission on Women.

Right now, she's engaged in mainstreaming GAD into the curriculum and instructional materials for information technology programs, alongside teaming it up with Outcomes-based Education (OBE). In doing so, she realized that embracing the concept of OBE, it is at the same time mainstreaming the concept of gender equality in the teaching and learning environment, eventually will help shape respectful, dignified and morally upright professionals.

Her work ethics is "don't settle for mediocrity, work towards quality," never fails to uncover new prospects. She always believed that a true educated person is someone who is not afraid to commit mistakes, knows to accept failures, stands bravely amidst enmity and strive to learn, unlearn and relearn to continuously improve their crafts.