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short Paper

Bawal Bastos App: Using Mobile and Web Technology for Handling Reports of Gender-Based Sexual Harassment in Public Spaces

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Abstract

Purpose – This study aims to develop a two-way information technology system consisting of a mobile application (BLB App) and a web application (BLB Admin Portal) for filing and handling case reports on gender-based sexual harassment (GBSH) in public spaces of Los Baños, Laguna, Philippines. Establishment review and emergency features such as location-based messaging and press-to-call barangay hotline directory were also implemented.

Method – The study employed descriptive and developmental research methodologies, incorporating the Safe Spaces Act of the Philippines during the conceptualization phase. The software development process adhered to the Scrum Agile methodology.

Results – The acceptability evaluation demonstrates that both the mobile and web applications meet all criteria across the indicators. The BLB App's geolocation accuracy,

evaluated in various locations in Los Baños, Laguna, revealed statistically satisfactory results.

Conclusion – The BLB mobile application facilitates comprehensive case reporting, capturing incident details such as location, time, victim information, incident details, and evidence upload. The BLB admin portal streamlines case report management, including case closure, routing cases to the appropriate channels, and data analysis, which features heatmap generation based on case data.

Recommendations – Several recommendations were identified such as improving accessibility of emergency features through widgets or gesture recognition; enhancing the Safe Spaces Act information page; strengthening data security with encryption for personal identifiable information; and expanding the scope of case reporting to include Violations Against Women and their Children.

Research Implications – While the study focuses on a specific locality, the application could be adopted by other local government units due to its alignment with national policy. It also emphasizes the need for further investigation into geolocation enhancements both locally and nationally and suggests that establishment review data could provide valuable insights for a more comprehensive analysis.

Keywords – gender-based sexual harassment, gender equality, mobile application, web application, geolocation

INTRODUCTION

Considering the global goal of achieving gender equality, mobile applications addressing violence against women (VAW) were abundantly developed. Most of these mobile apps were reporting and evidence building, and some may be emergency apps which can help victims in emergency situations (Eisenhut et al., 2020). Other mobile apps were categorized as avoidance, education and supporting apps.

Some of the generic mobile apps, which were not directly developed to address VAW, include built-in emergency features such as alerting the public through siren sounds or the activation of the mobile phone's torch or flashlight. In contrast, other apps have been specifically designed to tackle VAW-related issues. Most of these apps share common features such as an Emergency SOS function for quickly alerting authorities or emergency contacts, often including the current location of the user; a case reporting feature, with some apps allowing reporters to remain anonymous; an evidence upload function for submitting images, videos, or audio recordings; a VAW information dissemination function for raising awareness; and a siren alarm function to attract public attention in case of VAW emergency (Balahadia & Astoveza, 2020).

Following the methodology outlined by Eisenhut et al. (2020), the proponents utilized the systemic review approach and determined that the BLB App falls under the categories of reporting and evidence-building, as well as emergency, with reporting and evidence collection serving as its primary features.

Based on the common themes of the related systems studied, the authors identified some features that will be implemented in BLB app. These features include case reporting, sending an emergency message with location, sounding an alarm on minimum tap, uploading evidence, and an information page. The authors incorporated other features based on the provisions of the Safe Spaces Act, including the press-to-call barangay hotlines, which considered minimum tap for accessibility. Moreover, the authors incorporated an establishment review feature that solicits comments from the users on local establishments' observance of the Safe Spaces Act.

The research incorporates three main theoretical frameworks in developing the applications: the Legal Compliance Framework, the Empowerment Theory, and from a technical standpoint, the Technology Acceptance Model (TAM). The Legal Compliance Framework ensures that the software development process adheres to laws, regulations, and legal standards concerning gender-based sexual harassments on public spaces in the Philippines. The Empowerment Theory, on the other hand, emphasizes the importance of developing the application which advocates users' critical awareness regarding the provisions and implications of the Safe Spaces Act. From a technology standpoint, the Technology Acceptance Model (TAM) plays a crucial role in this study's evaluation process. TAM proposes that ease of use and perceived usefulness (Ma and Liu, 2006; Abuhassna, 2023) of a technology are the main indicators of users' acceptance.

The authors collaborated with the Gender and Development (GAD) Office Head of Los Baños, Laguna in developing the mobile application, *Bawal Bastos sa LB* App, which intends to fill the gap in filing reports of gender-based sexual harassment (GBSH) cases. The study aims to capitalize on the ubiquity of mobile applications to disseminate awareness of the Safe Spaces Act and the crimes punishable by it. The study also develops a web-based platform to assist LGU authorities in handling and routing GBSH complaints to appropriate channels.

The Philippines has the judicial means in combatting GBSH but the implementation of a reachable channel for reporting cases is still in its infancy. To fill this gap, the study was conceptualized and developed. The research also underlines the importance of effectively responding to GBSH emergencies and highlights the role of geolocation accuracy in the development of applications that collect location data. This is particularly relevant for applications like the BLB app, which relies on precise location information for its emergency features. The study evaluates the acceptability of geolocation accuracy within the local context and emphasizes opportunities for accuracy improvements, both locally and nationally.

LITERATURE REVIEW

Gender-Based Sexual Harassment

Gender-Based Violence (GBV) is an umbrella term, defined by the United Nations High Commissioner for Refugees (2024), for any "harmful act that is perpetrated against a person's will and that is based on social ascribed (i.e. gender) differences between males and females". GBV highlights the systemic inequality between males and females and focuses on the more prevalent violence against women (VAW) and girls. VAW has a strong relationship to the unequal power distribution between women and men as dictated by the social norms and stereotypes. Philippine Commission on Women (PCW) highlighted the societal stereotypes which define men are the leaders and the providers while women are the nurturers and the men's companions. This societal perception leads men to gain more power over women and in some cases, VAW becomes a form of expression for men to retain power over women.

While the focus of GBV is typically among women and girls, who are the most common victims - the term is also used to highlight gender-based forms of violence against men and boys. The GBV against men, like GBV against women were typically under-reported primarily due to the norms of masculinity (Inter-Agency Standing Committee, 2015) which inhibits vulnerability among men. This was also evident in a study by Lafadchan and Ullalim (2022) in Bontoc, Mountain Province in the Philippines where in there were no reported street harassments among male but surveys show that some male college students experienced street harassments but have not filed a case because it was deemed "unmanly". According to the Inter-Agency Standing Committee (IASC) 2015 Guidelines for Gender-Based Violence Interventions in Humanitarian Settings, many countries do not recognize sexual violence against men through laws and some even have laws criminalizing the survivor. It is evident that revising legal framework is necessary to prevent sexual victimization stereotyping and effectively manage GBV against men (Mphatheni et al., 2022).

The IASC highlighted that GBV perpetrated against lesbian, gay, bisexual, transgender, intersex and asexual (LGBTQI+) people is a significant concern. According to the IASC guideline, GBV against LGBTQI+ persons have been driven by the desire to punish those that are seen defying gender norms. Homophobia and transphobia are key contributing factors to this form of GBV (IASC, 2015). To effectively address GBV, Ongsupankul (2019) argues that an identity-based approach is essential. This approach must include LGBTQI+ individuals, as their gender identities are central to the violence they face (Ongsupankul, 2019).

The acts classified as GBV may be in physical, sexual, or psychological form and may happen in private or in public (IASC, 2015). The sexual form of GBV can be referred to as gender-based sexual harassments. Policies and national laws on criminalizing gender-

based sexual harassments, as well as other form of GBV, differ from one country to another. In a 2019 United Nations University report, it was highlighted that many countries lack laws that will protect people against sexual harassment, especially in public spaces (Lim, Ghani & Remme, 2019). Other significant barriers include confusion in what defines gender and sexual harassments, unfamiliar reporting processes and existence of multiple avenues for reporting cases (Zeidan et al., 2022).

Safe Spaces Act of the Philippines

On April 17, 2019, the Republic Act 11313 or the Safe Spaces Act (also informally known as the Bawal Bastos Law) was signed into law. It is an "act defining gender-based sexual harassments in streets, public spaces, online, workplaces and educational or training institutions". The act defined gender as "socially ascribed characteristics, norms, roles, attitudes, values and expectations identifying the social behavior of men and women, and the relations between them". Additionally, gender identity was defined as the personal sense of identity as characterized by manner of clothing, inclinations, and behaviors in relation to masculine or feminine social norms. Male or female identity may have physiological characteristics of the opposite sex and is considered as a transgender person. The Safe Spaces Act protects persons of all genders against gender-based sexual harassments (GBSH) including "catcalling, wolf-whistling, unwanted invitations, misogynistic, transphobic, homophobic and sexist slurs, persistent uninvited comments or gestures on a person's appearance, relentless requests for personal details, statement of sexual comments and suggestions, public masturbation or flashing of private parts, groping, or any advances".

The act addresses GBSH in various public spaces, including restaurants, cafes, bars, clubs, resorts, water parks, hotels, casinos, cinemas, malls, and other privately owned places open to the public. Articles IV and V of the act specifically cover GBSH in workplaces and educational or training institutions, respectively. Ideally, in cases under Articles IV and V, victims should report incidents to the designated committees handling sexual harassment. However, the proponents recognize that victims may utilize a mobile application to report GBSH. Once a report is made, the Barangay VAW Desk Officer will have to review and communicate the case to the proper establishments and institutions for internal investigation (i.e. independent internal committee on decorum and investigation for the workplace establishment and Committee on Decorum and Investigation (CODI) for educational institutions).

Section 7 of the Safe Spaces Act IRR specifically categorized offense committed by a minor, in which the Department of Social Welfare and Development (DSWD) shall provide necessary disciplinary measures provided under the Republic Act 9344 or the Juvenile Justice and Welfare Act of 2006.

Aside from the case reporting, the common task of the LGU, the establishments and the school heads are to post in conspicuous places a copy of the Safe Spaces Act. In Section 6 of the IRR, providing the anti-sexual harassment hotlines is a must for establishments.

The Safe Spaces Act and its implementing rules and regulations (IRR) was the primary basis of the features of the mobile application and admin portal. It should be also noted that ordinances may vary among LGUs and some of the requirements for the BLB system is tailor-fitted to the municipality of Los Baños, Laguna.

Related Studies and Systems

Eisenhut et al. (2020) conducted a systemic review of 171 mobile applications addressing violence against women. In this study, mobile applications against VAW were categorized into five distinct categories: emergency app, avoidance app, education app, reporting and evidence-building app, and supporting app.

In India, a software application called Safecity (n.d.) was launched on December 26, 2012, in response to a rape case which happened in a bus in Delhi. Safecity is a crowdsourcing platform which gathers personal stories of sexual harassments and abuse in public spaces. The collected data are aggregated to present trends of sexual harassments reported in the communities through local map which is available for website visitors whether an individual or an institution. Details of sexual harassments are open to view in the map. According to the FAQs indicated in the Safecity's website, the users may report incidents anonymously though they would collect age, gender, and other non-personal information. Safecity claimed in their FAQs that there were cases when the police have acted based on the reports the platform received. In their example, street lighting was improved in Bandra, Mumbai were several cases of chain-snatching were reported. The actions of the authorities had resulted in immediate decrease in chain-snatching cases in the said area (Safecity, n.d.).

In emergency situations, such as when individuals are in immediate danger from GBSH, various software solutions and scholarly articles have been reviewed. Both Android and iOS, for instance, have built-in SOS capabilities. Android users can use phone to trigger actions such as calling for help, sharing user's location with emergency contacts and recording video. However, the Android phone must not be in airplane mode or in Battery Saving mode to use the SOS feature (Google, n.d.). Meanwhile, in an iOS device, SOS can make calls automatically to local emergency number and shares location information with emergency services (Apple, n.d.). After the emergency call, the system alerts the nominated emergency contacts with a text message. iPhone users can also customize the SOS feature to enable different methods in initiating SOS call. iOS 16.3 and later versions introduced a new "Call Quietly" feature.

In addition to the built-in capabilities of major mobile operating systems, several mobile applications offer additional features beyond emergency calls or messaging. One example is the Flashlight, Screen, Torch, SOS mobile application (MobiEase, n.d.) which provides quick access to the mobile's flashlight. In iOS, an application called Flashlight + Compass + SOS (Lee, 2013) activates the device's torch immediately upon opening. This app also includes a siren feature.

HearMe, a mobile application for mitigating women harassment is equipped with features which can be used by a victim in immediate danger. This mobile application has lock screen access and blast instant siren on receiver device even if the device is in silent mode (Akash et al., 2016).

Balahadia and Astoveza (2020) studied some of the existing mobile applications in their research, which developed a framework for reporting violence against women and their children (VAWC). A common feature among these apps is the Emergency SOS function, which allows users to send a SOS message or call emergency hotlines with a single tap or shake gesture. One app, *Harras Map*, allows users to anonymously report incidents via SMS and visually displays violence hotspots, determined by the frequency of sexual harassment reports. Similarly, the *Watch Over Me* app also highlights violence hotspots and tracks the user's location, alerting them when they enter high-crime areas. On the hand, the Circle of 6 app allows sending of pre-programmed message to six friends and a GPS technology for tracking the location of the sender. Some apps also provide the ability to record evidence, such as images, videos, or audio. All the apps studied prioritize ease of use, with minimal button taps required for some operations. In addition, all of the apps provide information related to violence against women (VAW). Notably, the *Anabella* app features counseling services and a social media hub for victims. Both *Anabella and WomensHub* offer assistance with shelter and employment. The VAWFreePH app includes a sound alarm feature for VAW emergencies. The *iJuanaHelpMo* app, developed by Balahadia and Astoveza (2020), incorporates all these features, along with additional functionalities like fake calls and an assessment module aimed at raising VAW awareness.

Geolocation Technology

Geolocation is one enabling technology for allowing location attachment to the emergency messages. Aside from the applications discussed above, it is common for emergency response to get the details of the incidents and the location of the victim. For instance, the 911 emergency hotline of the United States of America (USA) connects callers to public safety call centers. According to Witkowski (2015), 911 was originally designed to support wired landline calls in which caller's location is known. The omnipresence of mobile phones made it is possible to call from virtually all locations with cellular network coverage. This is quite an improvement for emergency reporting and response, however, the issue with providing accurate location is borne.

Location is obtained with the use of global navigation satellite systems (GNSS), Wi-Fi (Ranasinghe et al., 2018) and cellular networks (Witkowski, 2015; Asaad and Maghdid, 2021). Ranasinghe et al. (2018) had defined quality of location information based on factors such as environmental (e.g. changes in sensor location and sensor removal / malfunction), device-related (i.e. sensor quality, operating system, processors, and sensor subsystems), signal-related, localization measurement and algorithm-related, and user-related (i.e. hand-grip style, user mobility, walking style, speed of user, on-body placement of sensors and step distance). In a study conducted by Baehr et al. (2020), it was also emphasized that the built-in sensors, which were produced by different manufacturers, and the mobile operating systems may affect the geolocation accuracy. Baehr et al. (2020) further elaborated environmental factors such as the density of the population and indoor settings can post a challenge in acquiring location accurately.

In the USA, network systems are being upgraded to the Enhanced 911 (E911) which has the capability to report the mobile number and location of 911 calls made from wireless phone. The USA's Federal Communications Commission (FCC), which developed E911 policies, set standards for cellular network to send user location and required send location accuracy within 50-300 meters depending on the type of technology used (Zandbergen and Barbeau, 2011).

The European Union also has set mandate on location services on mobile phones which requires the use of Galileo Navigation Satellite System (GNSS) positioning, Advanced Mobile Location (AML) and Wi-Fi Positioning to improve location transfer (Applus, 2022). Majority of the emergency calls in Europe is said to be placed through mobile phones (Galileo GNSS EU, 2019). According to Galileo GNSS EU site (2019), the accuracy of location information using cellular network tower is between 2km to 10km which can lead to significant errors which may result to time and even, lives lost. The site also highlighted that GNSS-based location accuracy is between 6 to 28 meters which could drastically improve emergency response.

Recognizing the critical role of geolocation accuracy in emergency response as presented in some of the literatures studied, the authors incorporated relevant literature into the research. While there were minimal requirements and policies for mobile phones' location accuracy in the Philippines, the research sheds light on factors affecting location accuracy and the acceptability of the location results.

METHODOLOGY

Research Design

The researchers used descriptive and developmental research approaches in this study. The descriptive research approach was first used in interviews conducted and secondary research of the existing literature about the subject of the study. This

approach conceived the definition of requirements which is used in the development. For the evaluation of the application's acceptability, the authors used the descriptive research approach as well by conducting surveys of usability and functionality acceptance with the users.

Data Collection Instruments

The researchers use a combination of data collection techniques: internet research and interview. The researchers gathered significant data from reliable sources on the internet regarding topics closely related to this study such as the sexual harassments, applications addressing sexual harassments, systemic reviews of anti-sexual harassment applications and anti-VAW frameworks. Government websites, such as the Philippine Commission on Women (PCW) website and the Office of the Ombudsman, were used as the primary source of laws examined. Additionally, the researchers conducted interviews with the GAD Office Head of Los Baños, Laguna to gather information on local implementation and municipal ordinances on the Safe Spaces Act.

System Development Methodology

The authors used scrum agile methodology for the software development. Agile methodology divides the project into phases emphasizing continuous collaboration and feedback (Atlassian, n.d.). Constant feedback from the clients allows software development to adapt to requirement changes (Ng, 2019).

Scrum agile methodology organizes development tasks in a time-boxed period and iterative manner. In the Scrum guide, Schwaber and Sutherland (2020) defines three specific roles within the Scrum team: the Developers, the Product Owner, and the Scrum Master. The developers are the members of the Scrum Team who create the usable increment or the product. The developers are responsible in creating the plan for each iteration and adapting their plan to changes. The product owner, on the other hand, is accountable for developing the product goal or the requirements. The product owner manages the product backlogs or the tasks of the development team. Lastly, the Scrum guide defines the role of the scrum master as a coach who ensures the team follow the scrum framework. Moreover, the scrum master steers the team towards removing impediments in the development of the product.

In this research, the authors served as the product owners designing and planning the features to be included. The main author served as the one-person development team and the scrum master. Though scrum is made for teams, the study showed that scrum can be applied in small team set-up and be as much effective as in a large team setup.

Conceptualization

An interview with the Los Baños GAD Office was initially conducted to gather the current state of implementation of the Safe Spaces Act in the municipality. The proponents then studied existing mobile applications concerning street harassments, their features and frameworks used. Based on the data gathered, the authors had come up with the initial features of the system.

Planning

After analyzing the data gathered from the conceptualization, the authors defined the scopes of the system to be developed including its features and main goal. Schedule and timelines were also defined and considered the limited time allotted for the project in refining the requirements.

Requirements Definition

The authors had another interview with the GAD Office Head of Los Baños, Laguna for requirements assessment. The end-users and the functionalities for the system were defined in this phase. In summary, the functional requirements were defined.

After the finalization of the functional requirements, the authors began to assess the technical requirements of the whole system. The technical requirements defined includes the availability of the mobile application in major mobile operating systems and the authentication process of the systems.

Design and Architecture

In this phase, programming languages to be used for the development were identified considering the functional and technical requirements from the requirements definition phase. Three programming language were selected: one to be used for the mobile application, the web application, and the backend API. The right database management system (DBMS) was studied and selected.

For the user interface of the mobile and web applications, the features were translated into screen designs considering user experience. The mobile application and the web application screens, including navigation, were designed.

Development and Testing

In this phase, the researchers had implemented the systems through coding. As with the scrum framework, development was time-boxed and iteratively done. The sprints were planned according to features target for completion. In this study, the definition of complete for a feature means that the backend and frontend worked as expected and

were integrated, code testing was completed, and feature simulation testing was done. Demonstration was also done in this stage and feedback is gathered. The feedback gathered will be put in the tasks backlog and slot into a sprint for development.

Evaluation

The mobile application is evaluated using the Likert Scale to measure the application's usability and acceptance. Open comments were also gathered for the continuous improvement of the application. Location accuracy testing was conducted by the researchers through triggering the Send Emergency Message feature at random locations in the locale of the study and recording the location accuracy.

System Architecture

The system developed follows the client-server model. The BLB mobile application and the BLB admin portal were the client applications which interacts with the user through a user interface. On the other hand, the BLB API (backend service) is the server. The backend service provides interface between the client applications and the persistence layer (database). It is responsible for processing and managing data or resources.

The researchers considered the following in choosing the technology stack (tech stack) for the development: project requirements fit, cost, team expertise, community support and security. For the mobile application, the researchers considered the need to develop a cross-platform (i.e. Android and iOS) application.

Software Testing

The BLB app and admin portal undergone usability and acceptance evaluation from the target users. The admin portal was evaluated by the Barangay VAW Desks Officers while the mobile app was evaluated by the potential users including residents and visitors. The Barangay VAW Desks officers also evaluated the mobile application. The evaluation indicators were group into three areas: Navigation and User Interface, Functionality and Usability.

Statistical Treatment

The usability and level of acceptance for the BLB mobile application and BLB admin portal were evaluated. The scope of evaluation involves the following areas: Navigation and User Interface, Functionality and Usability. Table 1 shows the 5-point Likert Scale used in interpreting the results of the evaluation.

Table 1. 5-Point Likert Scale for System Evaluation

Scale	Range	Descriptive Rating
5	4.21-5.00	Acceptable
4	3.41-4.20	Slightly Acceptable
3	2.61-3.40	Undecided
2	1.81-2.60	Slightly Unacceptable
1	1.0-1.80	Unacceptable

The degree of rating on Navigation and User Interface, Functionality and Usability indicators are computed using the mean and standard deviation of the set of scores. The mean location accuracy obtained using two mobile devices with varying hardware and software features tested in different locations using five trials was computed. The standard deviation of the data gathered in five trials across the different location tested was also calculated. As a benchmark for the acceptable location accuracy, the researchers established a threshold of <50 which means that the true location coordinates pair is within 50 meters from the measured location. To test whether there is a significant difference between the location accuracy obtained using the two mobile devices, the Mann-Whitney U-Test was utilized.

RESULTS

The developed system has two user interface components: one is the mobile application, which is to be called the BLB App, or BLB Mobile App, and the other is the web application, or the BLB Admin Portal. The mobile application is designed for the residents and visitors of Los Baños, Laguna, while the admin portal will be used by LGU authorities, including the Barangay VAW Desks, the Municipal Social Welfare and Development Office (MSWDO), and the Philippine National Police - Women and Children Protection Center (PNP WCPD), who are responsible for overseeing the implementation of the Safe Spaces Act.

Software Acceptance Evaluation Results

The BLB Admin Portal and BLB Mobile App were evaluated based on key indicators, including Navigation and User Interface, Functionality, and Usability. Table 2 presents the acceptability assessment of the BLB Admin Portal as evaluated by the Barangay VAW Desk personnel.

Table 2. BLB Admin Portal Acceptability Evaluation

Indicator Group	Mean	SD	Acceptance Level
Navigation and User Interface	4.47	0.77	Acceptable
Functionality	4.60	0.65	Acceptable
Usability	4.63	0.49	Acceptable

Tables 3 and 4 present the acceptability assessment of the BLB Mobile App as evaluated by the Barangay VAW Desk Officers and the potential users, respectively.

Table 3. BLB Mobile App Acceptability Evaluation (By VAW Desk Officers)

Indicator Group	Mean	SD	Acceptance Level
Navigation and User Interface	4.53	0.70	Acceptable
Functionality	4.56	0.69	Acceptable
Usability	4.57	0.60	Acceptable

Table 4. BLB Mobile App Acceptability Evaluation (By Potential Users)

Indicator Group	Mean	SD	Acceptance Level
Navigation and User Interface	4.77	0.42	Acceptable
Functionality	4.82	0.41	Acceptable
Usability	4.76	0.54	Acceptable

Location Accuracy Acceptability Test

This section presents the data needed to determine whether there is a significant difference between the accuracy values of locations obtained using Phone A and Phone B hardware assessed using five (5) trials per location tested and the acceptability of the accuracy values. Phone A and Phone B have different operating systems, cellular networks, Wi-Fi Technology and GNSS (Positioning Systems). For the baseline of acceptability test, the researchers set <50 as acceptable location accuracy value.

Table 5 presents the mean and median location accuracy obtained using Phone A and Phone B hardware.

Table 5. Mean and Median Location Accuracy Obtained Using Phone A and Phone B

Test Phone	Mean	Median
Phone A	4.61	4.55
Phone B	19.02	13.08

A Mann-Whitney U test was performed to compare the mean accuracy values obtained using Phone A and Phone B hardware in the different locations tested. The computed Wilcoxon test statistic, W (W) is 36.0 and the statistical significance (2-tailed p-value) of this test is 0.0009 (the p-value is adjusted for ties and is equivalent to the Mann-Whitney U test).

Plaintext Location Accuracy

The send emergency message feature fetches the location using the mobile app's location services and uses the resulting latitude and longitude for reverse geocoding and finally, extract the human-readable address. The researchers logged address fields extracted and noted some of the differences in the output from the test devices in terms of the reverse geocoded address. The researchers noted there is no difference between the city and country extracted from reverse geocoded addresses. The name field values were mostly different while street field values have some inconsistencies. iOS can retrieve the name of the barangay in the district field while no value in the district was provided by Android. The Region values were also different given that the region field context from the Android values seemed to be consistent with the local context while the region from iOS is the province. On the other hand, province in android is written in the subregion field while iOS does not provide field for the subregion. The last field analyzed is the formatted address field. The formatted address field, or the readily available structured address text, is only present in Android.

DISCUSSION

The mean values calculated from the evaluation results of the BLB Admin Portal for all indicators fell within the acceptable range (4.21-5.00) on the Likert scale established in this study. Similarly, the mean values derived from the evaluation of the BLB Mobile App by VAW Desk Officers and potential users also fell within the acceptable range. This unanimous acceptance across all assessed indicators, including Navigation and User Interface, Functionality, and Usability, indicates that both the BLB Mobile Application and the BLB Admin Portal were positively received by all test groups.

The overall mean location accuracy computed for Phone A, 4.61, is within the established acceptable baseline of <50, therefore, the location accuracy for Phone A is acceptable. Furthermore, the overall mean location accuracy computed for Phone B, 19.02, is within the established acceptable baseline of <50, therefore, the location accuracy for Phone B is acceptable. It can be observed that the p-value of 0.0009 is less than 0.05 (i.e., $p < .05$). Therefore, it can be concluded that there is a statistically significant difference in the median hardware variety accuracy between the two sets of values which are obtained using the Phone A and Phone B hardware. The difference in the accuracy is deemed to be resulted by the difference in GNSS, Wi-Fi technology, operating systems and cellular networks used by each of the phones.

The researchers noted differences in the reverse geocoding results obtained using the test phones. The geocoded results vary in terms of what each test phone provided in each address field. The study finds out that some address fields (i.e. city and country) are consistently similar for each test group; while some address fields have inconsistencies (i.e. name and street); some fields are present in one but absent in another (i.e. district,

formatted address); and lastly, a local address data may be presented in different fields (i.e. subregion and region).

The differences in geocoding results obtained is applicable to the municipality of the study, Los Baños, Laguna. However, the geolocation accuracy may vary from other areas of the region since geographic location may be affected by external factors such as the strength of cellular network coverage, the density of the population and other environmental factors.

CONCLUSIONS AND RECOMMENDATIONS

Based on the study's objectives and findings, several conclusions can be drawn. Firstly, the BLB mobile application was designed to facilitate comprehensive case reporting, capturing incident details such as location, time, victim information, incident details, and supporting evidence upload. Secondly, the BLB admin portal was developed with features for efficient case handling, including closure and routing of case report to the correct channel. Additionally, the study identified and integrated value-added features into the mobile application such as: information page which intends to promulgate awareness on Safe Spaces Act; establishment review feature which solicit reviews from users on establishments safety in accordance with the Safe Spaces Act; sound alarm feature which triggers siren sound on button tap; send emergency message feature which creates a templated message with the location of the user to the speed contacts and emergency hotlines; and lastly, press-to-call barangay hotline directory feature. Furthermore, data-driven features were implemented in the admin portal, such as geocoded heatmaps and case count analysis, to provide insights into incident patterns and trends. Moreover, the evaluation of the BLB App conducted with Barangay VAW desk officers and potential users demonstrated that the mobile application is acceptable in terms of navigation, user interface, functionality, and usability. Lastly, the evaluation of the BLB Admin Portal with the sampled Barangay VAW Desk Officers shows that the BLB admin portal developed is acceptable in terms of navigation, user interface, functionality, and usability.

Based on the conclusions made in this study, the following are proposed recommendations for future researchers to improve the capabilities of the applications developed. Firstly, for the emergency features of the application, further improvement on the accessibility can be implemented. One option is to develop widgets which can be easily accessed in mobile phone’s dashboard. Another option is to implement a background process to listen to gestures (e.g. shake) or to assign accessibility shortcuts for the emergency features. Additionally, the information page can be improved by providing a more detailed information campaign on Safe Spaces Act. Regarding personal identifiable information (PIIs), which the application collects, the researchers recommend using a strong database encryption upon deployment or addition of column-level encryption to protect further protect the data from unlawful usage. Lastly, the authors recommend considering expansion of scope of the case reporting to include VAWCs

(Violations Against Women and their Children) which the Barangay VAW Desk Officers suggested.

IMPLICATIONS

The research demonstrates the feasibility of developing the application for a single local government unit, suggesting the potential for expansion to a national level. The case reports' data analysis features will be more useful if the GBSH cases are to be reported through the application. The decision on whether the application will be the official reporting tool for GBSH will be the local government unit's prerogative. Additionally, the research offers means in gathering establishment review through the mobile application, presenting an opportunity for utilizing the gathered data for comprehensive analysis.

The study highlights discrepancies between reverse geocoded results and plaintext locations, despite location accuracy meeting the study's predefined standards. This suggests a need for further investigation into geolocation improvements, particularly in the study's specific locale. Additionally, the findings indicate that geolocation accuracy could be explored on a broader national scale, as environmental factors such as population density and cellular network coverage may impact accuracy. The study found that some countries have implemented policies related to device hardware and cellular network infrastructure that improve geolocation accuracy, particularly for emergency response purposes (e.g., FCC E911). The Philippines could benefit from adopting similar policies and regulations to enhance geolocation precision, which could, in turn, support the development and effectiveness of mobile applications that rely on accurate location data for emergency situations.

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DECLARATIONS

Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this research paper. Any potential conflicts or competing interests are hereby disclosed, and the research is presented with complete impartiality.

Informed Consent

The respondents acknowledge and the research provided the declaration the Data Privacy Agreement instigated in the study. The data subject acknowledges that information will not be shared to anybody and will only be used for data analysis and data reports and for the research mentioned.

Ethics Approval

The article has followed all ethical standards for research.

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