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Bantay Kuryente: GIS Smart Mapping for Convenient Tracking of Electrical Needs in Bogo City, Cebu

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Abstract Introduction – Electrical concerns such as power interruptions, low voltage, unsafe poles, damaged lines, and unlit streetlights require an organized system for reporting, mapping, monitoring, and tracking to support faster coordination and response in Bogo City, Cebu. Methodology – This study used the Plan-Do-Check-Act (PDCA) approach with descriptive evaluation to develop Bantay Kuryente, a GIS-based web and mobile application with features for report submission, geotagging, GIS map visualization, AI-assisted incident classification, evidence upload, status tracking, notifications, user verification, role-based access, and report monitoring. Results – The system achieved 100% accuracy in classifying incidents and 100% accuracy in geotagging, while major system actions such as report submission, report acceptance, status updating, task completion, and report confirmation were processed in about one second or less. The user acceptance evaluation from 60 respondents showed Very Satisfied ratings in all DOST TAP-TEEPS dimensions, with composite means of 3.72 for technical feasibility, 3.75 for economic feasibility, 3.76 for environmental soundness, 3.71 for political acceptability, and 3.73 for social acceptability. Conclusion – The findings show that Bantay Kuryente is a functional, acceptable, and useful GIS-based system for improving the reporting, mapping, monitoring, and tracking of electrical concerns in Bogo City. Recommendations – Future researchers may pilot the system in selected barangays, involve more respondents, improve the notification and monitoring features, and add offline or low-connectivity reporting for better accessibility during emergencies.

Keywords — Bantay Kuryente, GIS, smart mapping, electrical concerns, web and mobile application, DOST TAP-TEEPS.

I. INTRODUCTION

Electricity is essential in modern communities because it supports household activities, education, healthcare, business operations, communication, and public safety. When electrical problems occur, especially power interruptions, damaged electrical lines, low voltage, unsafe poles, and unlit streetlights, residents and concerned offices need an organized way to report, locate, verify, and monitor these concerns. Without a centralized and map-based reporting system, reports may become scattered, delayed, or difficult to track.

Geographic Information System (GIS) technology provides a useful approach for organizing location-based information. Web-GIS platforms can support infrastructure and hazard management by allowing users to collect, visualize, and share spatial information for decision-making [1]. In the context of electrical service concerns, GIS can help show where problems are reported, identify recurring affected areas, and support coordination among residents, local government units, disaster offices, and electric cooperative personnel.

In the Philippines, power interruptions remain a continuing concern. Electricity supply interruptions may be caused by environmental, technical, and supply-related factors, and these interruptions can affect households, public services, and local economic activities [2], [3]. In local communities, traditional reporting through calls, messages, or direct communication may help inform concerned offices, but these practices often lack exact geotagged locations, visible report tracking, organized records, and role-based monitoring.

Bantay Kuryente was developed to address this need by providing a GIS-based web and mobile system for reporting, mapping, monitoring, verifying, classifying, and tracking electrical concerns in Bogo City, Cebu. The system allows public users or residents to submit reports with location details and supporting evidence. It also provides role-based access for public users, administrators, volunteers, and electricians. Public users can view only their own reports, volunteers and electricians can access only the reports permitted for their roles, and administrators can view all reports and manage records through the web platform.

This study focused on developing and evaluating Bantay Kuryente based on system performance and user acceptance. The system was tested in terms of accuracy of classifying incidents, accuracy of geotagging, and response time. It was also evaluated through user satisfaction using the DOST TAP-TEEPS criteria: technical feasibility, economic feasibility, environmental soundness, political acceptability, and social acceptability.

II. STATEMENT OF THE PROBLEM

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The main objective of this study was to develop an application and web app-based GIS smart mapping system for electrical needs called Bantay Kuryente.

Specifically, this study aimed to:

1. Identify the current practices in reporting and documenting electrical concerns in Bogo City, determine their drawbacks, and gather system requirements for an improved reporting mechanism.
2. Develop a web app-based GIS electrical needs mapping system that could send information about electrical concerns, support geotagging, classify incidents, store and retrieve reports, and notify and track the status of submitted reports.
3. Evaluate and test the system based on the following metrics:
   3.1 Accuracy of classifying incidents;
   3.2 Accuracy of geotagging; and
   3.3 Response time.
4. Determine the users' acceptance based on their satisfaction with the developed system in conformity with the DOST TAP-TEEPS:
   4.1 Technical feasibility;
   4.2 Economic feasibility;
   4.3 Environmental soundness;
   4.4 Political acceptability; and
   4.5 Social acceptability.

III. METHODOLOGY

This section presents the research methodology of the study, including the approach, setting, respondents, research instrument, procedures, data gathering, and data treatment. The study employed the Plan-Do-Check-Act (PDCA) approach, supported by descriptive evaluation, to guide the development, testing, evaluation, and improvement of Bantay Kuryente, a GIS-based web and mobile system for reporting, mapping, monitoring, and tracking electrical concerns in Bogo City.

A. Research Design

The study used the Plan-Do-Check-Act (PDCA) approach as the research design for the development and evaluation of Bantay Kuryente. The Plan phase involved identifying existing reporting practices, drawbacks, user roles, issue categories, and mapping needs. The Do phase involved the development of the GIS-based web and mobile system. The Check phase involved system testing based on classification accuracy, geotagging accuracy, and response time, as well as user acceptance evaluation using the DOST TAP-TEEPS criteria. The Act phase involved using the results of testing and evaluation as a basis for identifying possible system improvements.

B. Research Environment

The study was conducted in Bogo City, Cebu. The location was selected because it was the target area of application for Bantay Kuryente. Bogo City has residential communities, commercial areas, public offices, and barangays that depend on safe and reliable electrical service. The area was suitable for testing the system because electrical concerns may occur in different locations and require proper documentation, accurate location identification, organized monitoring, and coordination.

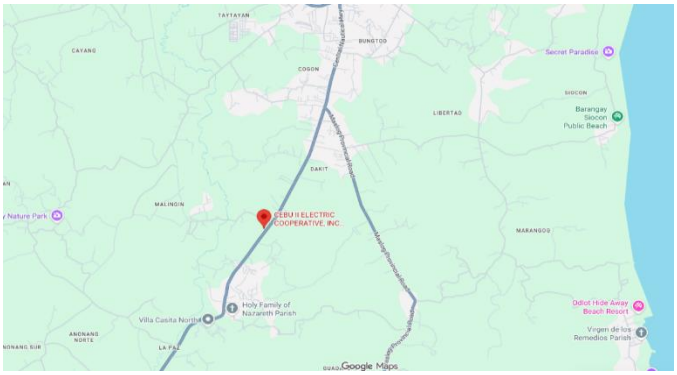

Fig. 1 Research Setting

C. Research Respondents

The respondents of the study were 60 selected individuals who were given the opportunity to experience and evaluate the Bantay Kuryente system. They were chosen through convenience sampling based on their availability, willingness to participate, accessibility to the survey, and ability to provide relevant feedback. The respondents represented different types of users who could evaluate the reporting, mapping, monitoring, and tracking functions of the system.

D. Research Instrument

The main research instrument was a researcher-made survey questionnaire administered through Google Forms. The questionnaire contained two main parts: the respondents' profile and the evaluation of the system based on the DOST TAP-TEEPS criteria. A four-point Likert scale was used, with response choices of Very Satisfied, Satisfied, Unsatisfied, and Very Unsatisfied. In addition, selected users were given a brief orientation and an opportunity to experience the system before answering the questionnaire.

E. Research Procedure

The researchers reviewed related literature and gathered information on existing electrical concern reporting practices in Bogo City. They identified system requirements and designed the database, user interface, mapping functions, user roles, and incident classification features. Bantay Kuryente was then developed as a GIS-based web and mobile system. After development, the researchers conducted system testing based on accuracy of classifying incidents, accuracy of geotagging,

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and response time. The respondents then evaluated the system using the survey questionnaire.

F. Data Gathering Procedure

Two sets of data were gathered. The first set was system testing data, which included representative electrical concern reports used to test incident classification accuracy, geotagging accuracy, and system response time. The second set was user acceptance data, gathered from the 60 respondents through the researcher-made questionnaire. Before answering the survey, selected users were oriented and allowed to experience the system through actual use or demonstration.

G. Data Treatment

Accuracy percentage was used to determine the accuracy of classifying incidents and the accuracy of geotagging. The number of correct results was divided by the total number of test cases and multiplied by 100. Response time was measured in seconds based on the time required for the system to process major user actions. Frequency count and percentage were used for respondent profile data. Weighted mean was used to interpret each survey item, while composite mean was used to determine the overall rating for each DOST TAP-TEEPS dimension.

IV. RESULTS AND FINDINGS

The study presents the development and evaluation results of Bantay Kuryente as a GIS-based web and mobile system for reporting, mapping, monitoring, verifying, classifying, and tracking electrical concerns in Bogo City.

A. System Output

The developed Bantay Kuryente system provided interfaces for public users, admins, volunteers, and electricians. The public user interface supported map viewing, report submission, report tracking, and completion confirmation. The admin interface supported incident logs, report verification, user management, map monitoring, and report documentation. The volunteer and electrician interfaces supported job boards, report acceptance, assignment monitoring, status updates, and resolution notes. These outputs showed that the system was able to implement its intended functions for reporting, mapping, monitoring, and tracking electrical concerns.

B. System Testing Results

The system was tested based on incident classification accuracy, geotagging accuracy, and response time. Ten representative reports were selected to test incident classification. These included concerns categorized under High Severity, Medium Severity, and Low Severity. The system correctly classified all ten reports according to their expected severity levels, resulting in 100% classification accuracy.

The geotagging function was tested using ten report locations. The locations were checked through location searching and direct pin placement on the map. All ten report locations were accurately displayed on the intended map positions, resulting in 100% geotagging accuracy.

The response time of the system was observed during major actions, including report submission, report acceptance, status updating, task completion, and report confirmation. Results showed that these major actions were processed in about one second or less, indicating responsive system performance during testing.

TABLE I. System Testing Results of Bantay Kuryente

Evaluation Metric	Testing Basis	Result	Interpretation
Accuracy of Classifying Incidents	Ten representative electrical concern reports compared with expected severity levels	100%	All test reports were correctly classified
Accuracy of Geotagging	Ten test locations checked through map display, search, and pin placement	100%	All report locations were accurately displayed
Response Time	Major actions such as submission, acceptance, status update, completion, and confirmation	About one second or less	The system responded promptly during testing

The system testing results indicate that Bantay Kuryente performed accurately and responsively during the conducted tests. The incident classification result shows that the severity basis was properly followed by the system. The geotagging result shows that the GIS function can support location-based reporting. The response time result shows that the system can process common user actions within a short time, making it suitable for basic reporting and monitoring use.

C. User Acceptance Results

The user acceptance evaluation was conducted using the DOST TAP-TEEPS criteria. The system received a composite mean of 3.72 for technical feasibility, 3.75 for economic feasibility, 3.76 for environmental soundness, 3.71 for political acceptability, and 3.73 for social acceptability. All criteria were interpreted as Very Satisfied.

TABLE II. DOST TAP-TEEPS Evaluation of Bantay Kuryente

Criterion	Composite Mean	Interpretation
Technical Feasibility	3.72	Very Satisfied

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Economic Feasibility	3.75	Very Satisfied
Environmental Soundness	3.76	Very Satisfied
Political Acceptability	3.71	Very Satisfied
Social Acceptability	3.73	Very Satisfied
Overall Evaluation	3.73	Very Satisfied

The technical feasibility result indicates that respondents were satisfied with the system's performance, reporting process, map accuracy, tracking function, notification features, and consistency between the web and mobile platforms. The economic feasibility result indicates that respondents found the system useful in saving time, reducing effort, providing convenient access, and improving the efficiency of the reporting process. The environmental soundness result shows that the system was perceived as useful in identifying electrical hazards, supporting safer reporting, and assisting monitoring during emergencies or calamities.

The political acceptability result indicates that respondents were satisfied with the system's ability to support coordination between residents and authorities, proper report handling, and transparency in the reporting and resolution process. The social acceptability result shows that respondents found the system easy to use, clear, useful to the community, and suitable for continued use. Overall, the results suggest that Bantay Kuryente was favorably accepted by the respondents as a GIS-based system for community electrical concern reporting and monitoring.

VI. CONCLUSIONS

Bantay Kuryente was successfully developed as a GIS-based web and mobile application for reporting, mapping, monitoring, verifying, classifying, and tracking electrical concerns in Bogo City, Cebu. The system addressed the limitations of traditional reporting practices by providing structured report submission, geotagging, GIS map visualization, AI-assisted incident classification, notifications, status tracking, user verification, role-based report visibility, and report monitoring.

System testing showed that Bantay Kuryente achieved 100% accuracy in incident classification and 100% accuracy in geotagging based on the tested representative reports and locations. The system also processed major actions in about one second or less, indicating responsive performance during testing. The user acceptance evaluation showed that respondents were Very Satisfied with the system in all DOST TAP-TEEPS dimensions, with an overall evaluation of approximately 3.73. These findings indicate that Bantay Kuryente is functional, acceptable, and useful as a GIS-based reporting and monitoring system for electrical concerns.

Future improvements may include pilot implementation in selected barangays, expansion of respondents and actual users, further enhancement of tracking and notification features, and the development of offline or low-connectivity reporting functions for use during emergencies. The system may also be improved by adding more advanced analytics, priority dashboards, historical report summaries, and integration with existing local government or electric cooperative workflows.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization, Methodology; Author 2: Data curation, Writing-Original draft preparation, Writing-Reviewing; Author 3: Investigation, Validation, Visualization, Writing- Reviewing Author 4: Data curation, Writing-Original draft preparation

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GENERATIVE AI STATEMENT

The authors used ChatGPT solely as a language-support tool to improve the clarity, coherence, and grammatical accuracy of the manuscript. All AI-assisted outputs were critically reviewed, revised, and validated by the authors to ensure the accuracy, integrity, and originality of the content. The authors accept full responsibility for the final version of the manuscript and its published content.

ETHICAL CONSIDERATIONS

Prior to the data gathering, ethical approval was obtained from the University of Cebu Academic Research Ethics Committee (UCAREC). The approved protocol ensured adherence to the principles of respect for persons, beneficence, justice, voluntary participation, informed consent, confidentiality, and anonymity, and compliance with the Data Privacy Act throughout the research process.

DECLARATION OF INTEREST

The authors declare that they have no competing financial, professional, or personal interests that could have influenced the conduct, findings, or publication of this study.

DATA AVAILABILITY

Data will be made available by the corresponding author on request.

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