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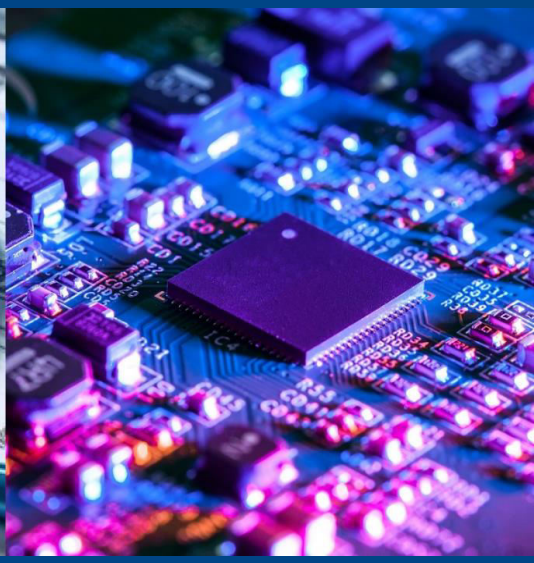

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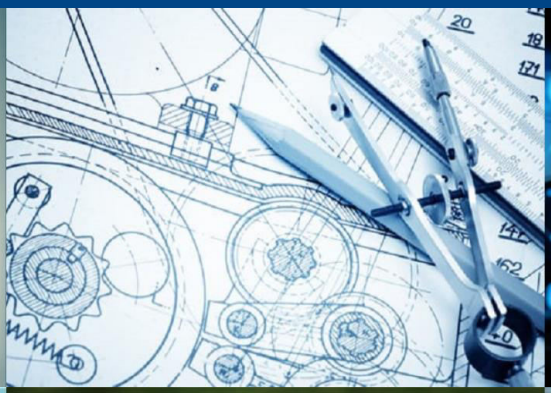

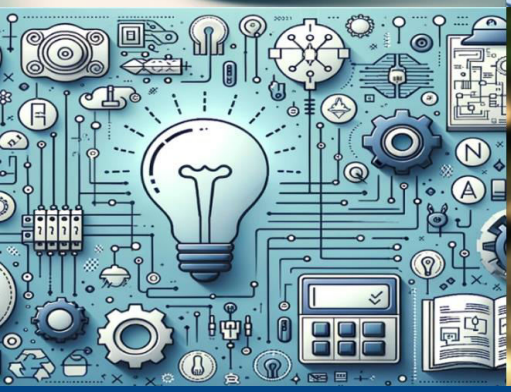

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VoltAlert: A Cross-Platform Automated Messaging System for Real-Time Power Outage Notifications in CarCanMadCarLan

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ABSTRACT: The power utility's inefficient manual outage notification system in Carcanmadcarlan caused major public inconvenience and hampered resource management. This study designed and evaluated VoltAlert, an automated, cross-platform messaging system to deliver timely, real-time alerts about power outages and restorations. Built using the Agile method, the system was quickly adjusted to create a reliable and user-friendly platform. Evaluation confirmed VoltAlert's success in automating alerts, drastically improving public preparedness and transparency, and enhancing the power cooperative's operations. The system successfully replaces inefficient manual processes, making it a necessary solution for delivering accurate disruption information and improving public convenience.

KEYWORDS: VoltAlert, Power Outage Notification, Cross-Platform, Automated Messaging, CarCanMadCarLan.

I. INTRODUCTION

A stable and consistent power supply is essential for modern life, supporting everything from household operations to critical business and hospital services. In the CarCanMadCarLan region, frequent and often unscheduled power outages pose a significant challenge, as the local utility, SURSECO II, relies on passive, manual communication methods like social media posts. This method creates a communication gap, as many residents lack reliable internet access or miss updates, leaving communities unprepared for service disruptions. This inefficiency leads to public inconvenience, disrupted routines, and financial losses from spoiled goods and lost data.

The pressing need for a simple yet robust alert system is highlighted by the success of related public alert systems, such as Mamamayan and the Surigao River Flood Watch (William Penaflor Rey et al., 2023 [2]; Magusara, 2022[1]), which underscore the potential of automated communication.

To address these deficiencies, this study developed VoltAlert, a proactive, automated, and location-based system that uses SMS and app notifications (via Facebook Messenger) to ensure timely and accurate information reaches all residents. By replacing the manual process, VoltAlert aims to significantly enhance public awareness, increase community resilience, and improve overall public safety and preparedness during power interruptions.

II. LITERATURE REVIEW

An analytical review of existing literature on automated notification systems and digital governance highlights the alignment of VoltAlert with current technological frameworks. As urban and rural infrastructure management becomes increasingly complex, many utility providers are shifting toward digital communication strategies. In the CarCanMadCarLan region, the primary priorities are the rapid dissemination of alerts and the accessibility of data across diverse devices. By moving away from manual processes and passive social media updates in favor of centralized, automated platforms, providers can offer a comprehensive service that includes real-time outage tracking and immediate restoration notifications. While utility automation has been widely studied, a significant gap remains in addressing the needs of consumers with limited internet connectivity. This study addresses that deficiency by utilizing cross-platform messaging to ensure inclusive and reliable information delivery for all residents.

Mag-usara [1] discussed the Surigao River Flood Watch and Warning App System in 2022. The author established the feasibility and success of SMS-based alert systems within the Surigao region, serving as a direct local precedent for VoltAlert's methodology. This study highlighted that in provincial areas, SMS remains the most reliable channel for emergency information. VoltAlert adopts this SMS-based approach to ensure that even in areas with poor data

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connectivity, power outage notifications are received promptly, mirroring the reliability found in Mag-usara's flood warning system.

Rey et al. [2] presented Mamamayan: An Android mobile community-based emergency reporting and notification system in 2023. Their work highlighted a significant shift toward community-based automated reporting to bridge the communication gap between citizens and service providers. They argued that timely information during crises is essential for public safety. VoltAlert aligns with this by automating the notification of unscheduled outages, transforming a passive cooperative-to-consumer relationship into a proactive, real-time information exchange.

Balcita and Palaoag [3] explored Building a Framework for the Integration of School Management Systems in 2020. While focused on education, their research provided the academic framework for integrating complex systems, specifically supporting the "Compatibility" and "Maintainability" aspects of software design. Their findings suggest that centralized digital platforms must be modular to adapt to changing user needs. VoltAlert utilizes these integration principles to connect its web-based administrative panel with third-party messaging APIs, ensuring long-term maintainability for SURSECO II.

Astoveza and Balahadia [4] proposed Swinelink: An Application for Swine Health Condition Reporting in 2022. This reference is crucial for the methodology of this study, as it demonstrates the application of the ISO/IEC 25010 Software Quality Model in a Philippine research context to evaluate system performance and usability. By following the evaluation standards set by Astoveza and Balahadia, VoltAlert was rigorously tested across eight quality dimensions, ensuring the final product meets international software standards while being highly acceptable to local stakeholders.

Lauer [5] discussed Cellular-enabled power outage detectors and SMS integration in 2022. Lauer provided the technical justification for using SMS integration as a reliable, real-time solution for power outage notifications, specifically addressing areas with inconsistent internet connectivity. The study emphasized that automated cellular alerts reduce the burden on utility helpdesks. VoltAlert implements this by replacing the manual response processes of SURSECO II with an automated trigger, directly addressing the "passive platform" issues identified in Lauer's research.

Table 1. Summary of Relevant Literature

No.	Paper Title	Author Name	Key Points	Remark
1	Surigao River Flood Watch	Mag-usara, 2022	Established feasibility of SMS alerts in the Surigao region [1].	Justifies the use of SMS for high-reliability local alerts.
2	Mamamayan Reporting System	Rey et al., 2023	Highlighted the shift toward community-based automated reporting [2].	Supports the need for proactive communication tools.
3	Integration Frameworks	Balcita & Palaoag, 2020	Provided framework for complex system integration [3].	Informs the compatibility and maintenance of the system.
4	Swinelink Application	Astoveza & Balahadia, 2022	Applied ISO/IEC 25010 to evaluate local software quality [4].	Standardizes the evaluation of VoltAlert's performance.
5	Cellular Outage Detectors	Lauer, 2022	Justified SMS as a solution for inconsistent internet areas [5].	Supports the cross-platform (SMS/Web) approach.

In conclusion, the literature review confirms that while the technology for automated alerts exists, its specific application to power utility cooperatives in the Philippines remains a vital area for development. VoltAlert fills this gap by providing a high-reliability, low-friction digital platform that aligns with international trends in automated infrastructure management.

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III. METHODOLOGY

Research Design

This study utilized a Descriptive Development Research Design to systematically create the Agile Model of the Software Development Life Cycle (SDLC) and evaluate the functionality and overall quality of the VoltAlert system, aligning its assessment with the ISO 25010 quality attributes.

Instrument

The system was evaluated using a survey instrument based on the ISO/IEC 25010 Software Quality Model, measuring eight key dimensions including Functional Suitability, Usability, and Security through a four-point Likert scale. These items were structured to assess the system's effectiveness in automating communication and notification processes for the cooperative.

Data Collection and Participants

The mixed-methods data collection process involved administering structured surveys to 70 participants in CarCanMadCarLan including 50 consumers, 10 SURSECO II Electric Cooperative Inc., and 10 IT experts while conducting semi-structured interviews and direct observations of manual procedures. Participation was voluntary , and a live demonstration of the system was provided to all evaluators prior to prototype testing to ensure an informed assessment of its cross-platform features and real-time accuracy.

Data Analysis

The gathered quantitative and system-generated information was processed through the following statistical and technical methods:

1. Weighted Mean: This was utilized to determine the average score for every ISO/IEC 25010 attribute, reflecting the collective evaluations provided by technical experts and end-users.
2. Verbal Interpretation: Numerical results were translated into qualitative labels to offer a meaningful evaluation of system quality "Very Highly Acceptable."
3. Cross-platform performance testing was conducted alongside qualitative feedback analysis to validate the system's uptime, response times, and overall efficiency in delivering timely power outage notifications.

IV. RESULTS AND DISCUSSION

System Features

VoltAlert features is a cross-platform messaging engine simultaneously delivers these real-time notifications via SMS and Facebook Messenger, ensuring residents receive information even without active internet connectivity.

Performance Evaluation

The system achieved a "Very Highly Acceptable" (VHA) rating across all metrics. The overall average score was 3.7. The highest characteristic was Security at 3.74, while the lowest characteristic was Reliability at 3.63.

Table 2. Performance Evaluation System Tabulation

Table	Quality Characteristics	Mean	Verbal Interpretation
1	Functional Suitability.	3.71	Very Highly Acceptable (VHA)
2	Performance Efficiency.	3.65	Very Highly Acceptable (VHA)
3	Compatibility.	3.71	Very Highly Acceptable (VHA)
4	Usability.	3.7	Very Highly Acceptable (VHA)
5	Reliability.	3.63	Very Highly Acceptable (VHA)
6	Security.	3.74	Very Highly Acceptable (VHA)
7	Maintainability.	3.71	Very Highly Acceptable (VHA)
	Over- All mean	**3.7**	**Very Highly Acceptable (VHA)**

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V. CONCLUSION

The implementation of VoltAlert marks a major shift toward digital utility communication in CarCanMadCarLan, successfully replacing manual methods with an automated engine that resolves information delays and consumer uncertainty. By integrating SMS and Facebook Messenger, the system overcomes internet connectivity barriers to provide inclusive, real-time notifications across all demographics.

Evaluation using the ISO/IEC 25010 standard yielded a "Very Highly Acceptable", confirming the system's security and readiness for deployment. Ultimately, VoltAlert enhances SURSECO II's operational efficiency while significantly improving community safety and transparency through reliable, real-time data management.

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