ISSN: 2473-4901
v12 n6689

Enhancing Digital Community Resilience during Power and Internet Outages: An SMS-Based Chatbot Approach

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Abstract

Power and internet outages during disasters can leave residents digitally isolated when timely communication and mutual aid are most needed. This study applies a design science research approach to propose the conceptual design of an SMS-based chatbot system for enhancing digital community resilience during such disruptions. Grounded in Activity Theory, the proposed artifact is designed to support human–bot interaction for outage reporting and information access, bot-mediated communication for forming temporary neighborhood support groups, and peer-to-peer collaboration for resource sharing. By using simple text messaging, the proposed system aims to support communication when internet-based applications and broadband services are unavailable. A use case demonstrates how the conceptual design could identify nearby affected users, facilitate consent-based group communication, and support coordinated assistance. Unlike existing utility SMS reporting systems that primarily support customer-to-provider communication or internet-dependent neighborhood platforms, the proposed conceptual artifact integrates low-bandwidth SMS communication with AI-mediated, consent-based neighborhood coordination for localized mutual aid during infrastructure disruptions. This study contributes to information systems research by identifying design requirements and proposing a conceptual artifact for AI-mediated, low-bandwidth community communication during infrastructure disruptions. It also offers design guidance for utility companies and emergency response stakeholders seeking accessible technologies to strengthen community resilience. Future research should instantiate and evaluate the proposed artifact through prototype development and empirical assessment.

Keywords: Digital Community Resilience, Design Science Research, SMS-Based Chatbot, Disaster Response, Bot-Mediated Communication, Peer-to-Peer Collaboration

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1. Introduction

When disasters disrupt power and internet services, affected residents may experience digital isolation at the moment when timely communication, localized information, and community support are most needed. Following Hurricane Beryl in 2024, widespread and prolonged power outages affected millions of customers across Texas, exposing significant spatial and socioeconomic disparities in outage duration and recovery. The event demonstrated how infrastructure disruptions can leave residents with limited access to information and reduced ability to coordinate assistance within their local communities (Li et al., 2025). In such situations, residents may be physically surrounded by neighbors but still lack practical ways to identify who needs help, who has available resources, or how assistance can be coordinated safely and efficiently. This communication gap can weaken both individual coping capacity and collective community response.

Reliable power and communication infrastructures are foundational to community resilience. Prior research suggests that resilient communities are better able to manage disruption, adapt to adverse conditions, and recover from major events (Nucifora Jr. et al., 2012; Ulak et al., 2018). However, power outages can disrupt healthcare services, economic activity, public safety, and household well-being (Mukherjee et al., 2018; Shuai et al., 2018). These challenges become more severe when internet-based platforms, mobile applications, and broadband services are unavailable or unreliable. Although many emergency communication systems depend on web portals, mobile applications, or online outage maps, these tools may become inaccessible during infrastructure disruptions. In contrast, Short Message Service (SMS) remains one of the most widely available low-bandwidth communication channels and can continue supporting basic communication when mobile data services are degraded.

Existing communication technologies only partially address this challenge. Utility companies commonly provide SMS services for outage reporting and restoration updates, but these systems primarily support communication between customers and service providers. Community-oriented platforms such as Nextdoor, WhatsApp, and Facebook facilitate neighborhood interaction and information sharing; however, they generally depend on internet connectivity and are not specifically designed to support AI-mediated, consent-based coordination among nearby residents during widespread infrastructure disruptions. Consequently, there remains an opportunity to explore how low-bandwidth communication technologies can better support localized mutual aid when conventional internet-based services are unavailable.

Information systems research has increasingly emphasized digital resilience, defined as the capacity of individuals, organizations, and communities to use digital technologies to withstand, adapt to, and recover from disruptive events (Tim & Leidner, 2023). During disasters, digital resilience extends beyond maintaining organizational operations to enabling localized communication, resource coordination, and mutual assistance among affected residents. Addressing these challenges requires information systems that remain accessible under degraded communication conditions while facilitating both information exchange and community collaboration.

To address this problem, this study applies a design science research approach to propose the conceptual design of an SMS-based chatbot system for enhancing digital community resilience during power and internet outages. Grounded in Activity Theory, the proposed conceptual artifact is intended to support human-bot interaction for outage reporting and information access, bot-mediated communication for forming temporary neighborhood support groups, and peer-to-peer collaboration for mutual aid. Rather than presenting an implemented system, this study develops a conceptual artifact and identifies the design requirements needed to support AI-mediated, low-bandwidth community communication during infrastructure disruptions.

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This study makes three contributions. First, it identifies design requirements for AI-mediated, low-bandwidth communication systems intended to enhance digital community resilience during power and internet outages. Second, it proposes the conceptual design of an SMS-based chatbot artifact that integrates outage reporting, location-aware neighborhood coordination, and consent-based peer-to-peer mutual aid. Third, it demonstrates how Activity Theory can inform the design of information systems that support localized community response under constrained communication conditions, thereby providing a foundation for future artifact instantiation and empirical evaluation. The remainder of the paper presents the theoretical foundation, research method, design requirements, conceptual system design, use case demonstration, proposed evaluation framework, and implications for research and practice.

2. Theoretical Background and Design Science Approach

This study is grounded in digital resilience, Activity Theory, crisis informatics, and design science research. Digital resilience refers to the capacity to use digital technologies to withstand, adapt to, and recover from disruptive events (Tim & Leidner, 2023). During disasters, digital resilience becomes a community-level concern because residents need timely information, localized communication, and resource coordination when normal infrastructures are disrupted. However, internet-based systems may be unavailable during power and network outages. This creates a need for low-bandwidth communication artifacts capable of supporting community response under constrained communication conditions.

Crisis informatics research emphasizes how people use information and communication technologies to seek information, share updates, and coordinate action during emergencies (Palen & Vieweg, 2008). Much of this work highlights the importance of digitally mediated public participation during crisis events. More recent reviews have shown that social media and online community platforms have become central to crisis communication, enabling information sharing, situational awareness, and volunteer coordination during emergencies (Reuter & Kaufhold, 2018). However, these communication tools generally depend on internet connectivity, social media platforms, or mobile data services. Recent research examining Hurricane Beryl demonstrated that prolonged power outages created substantial spatial and socioeconomic disparities in service disruption, reinforcing the importance of resilient communication mechanisms during infrastructure failures (Li et al., 2025). In contrast, the conceptual artifact proposed in this study uses SMS to support communication when internet-based tools are unavailable or unreliable. This focus extends crisis informatics by examining how low-bandwidth, chatbot-mediated communication can support localized mutual aid during infrastructure disruption.

Existing communication technologies serve different purposes during disasters. Utility SMS services primarily facilitate customer-to-provider communication, while internet-based community platforms emphasize social interaction and information sharing among residents. The proposed conceptual artifact integrates elements of both paradigms by combining the reliability of SMS-based communication with AI-mediated neighborhood coordination, thereby supporting localized collaboration during infrastructure disruptions. Table 1 summarizes these communication paradigms. A detailed feature-by-feature comparison is provided in Appendix A.

Table 1. Positioning the Proposed Artifact Among Existing Approaches

Approach	Primary Communication	Primary Objective
Utility SMS Systems	Customer ↔ Utility	Outage reporting and restoration updates
Internet-Based Community Platforms	Community ↔ Community	Social interaction, information sharing, and volunteer coordination
Proposed Conceptual Artifact	Resident ↔ Chatbot ↔ Community	AI-mediated neighborhood coordination for digital community resilience during infrastructure disruptions

As shown in Table 1, existing communication approaches primarily emphasize either utility service communication or internet-based community interaction. The proposed conceptual artifact integrates elements of both paradigms by introducing an AI-mediated intermediary that facilitates communication

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among residents while leveraging the reliability of SMS during internet outages. In doing so, the proposed design supports localized information exchange, neighborhood coordination, and mutual aid under degraded infrastructure conditions.

Activity Theory provides the theoretical lens for understanding how the chatbot mediates individual and collective action. Activity Theory views human activity as goal-oriented, socially situated, and mediated by tools, rules, community structures, and divisions of labor (Engeström, 2000). It has been widely used in human-computer interaction and information systems research to examine how technological artifacts shape user behavior and collaborative practices (Bertelsen & Bødker, 2003; Chen et al., 2013). As shown in Figure 1, the affected resident is the subject, the outage-related need is the object, and the SMS-based chatbot is the mediating tool. The community includes nearby residents, utility providers, and emergency response stakeholders. Rules govern consent, privacy, participation, and appropriate communication, while the division of labor emerges as users assume roles such as resource seeker, resource provider, or coordinator.

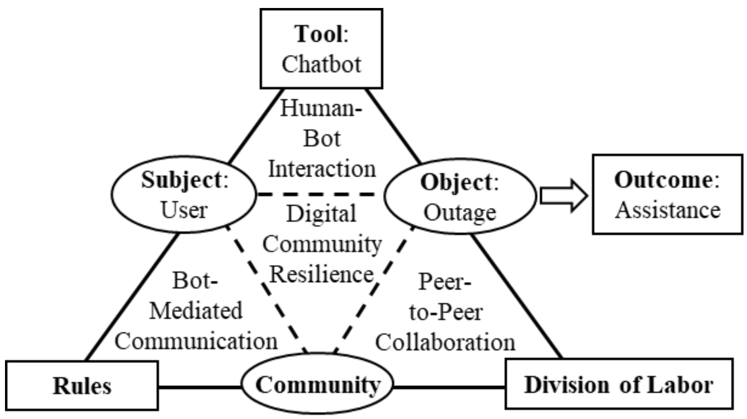

Figure 1. Activity System of Digital Community Resilience

This theoretical framing guides the design of the proposed conceptual artifact. The chatbot does not merely transmit information between users and a utility provider; it supports a broader activity system in which affected residents can report outages, locate nearby needs and resources, and coordinate assistance. By mediating these interactions, the chatbot helps transform isolated individual experiences into collective community response.

This study follows a design science research approach. Design science research is appropriate because the goal is to propose and conceptually demonstrate an information systems artifact that addresses a practical problem while contributing design knowledge (Hevner et al., 2004; Gregor & Hevner, 2013). The conceptual artifact proposed in this study is the design of an SMS-based chatbot system for enhancing digital community resilience during power and internet outages. Following the design science research process, the study identifies the problem of digital isolation during infrastructure disruptions, defines the objectives of a low-bandwidth communication solution, proposes the conceptual chatbot artifact, illustrates its application through a use-case scenario, and discusses a proposed evaluation framework (Peffers et al., 2007).

The proposed conceptual artifact is guided by three core design mechanisms. First, human-bot interaction allows residents to report outages, request information, and receive responses through SMS. Second, bot-mediated communication enables the chatbot to identify nearby affected users and form temporary support groups based on location and consent. Third, peer-to-peer collaboration allows residents to coordinate mutual aid, such as sharing supplies or local information. Together, these mechanisms translate the theoretical concepts of mediation, community, rules, and division of labor into actionable system features. The following section identifies the design requirements and system objectives that guide the conceptual design of the artifact.

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3. Design Requirements and System Objectives

Building on the theoretical foundations and design science research approach, this section identifies the design requirements (DRs) that guide the conceptual design of the proposed SMS-based chatbot artifact. These requirements translate the Activity Theory constructs of tool mediation, community participation, rules, and division of labor into design objectives that support digital community resilience during power and internet outages.

DR1. Low-Bandwidth Accessibility

During disasters, internet-based applications, utility websites, and mobile apps may be unavailable or unreliable. Therefore, the artifact should operate through a communication channel that remains functional under constrained network conditions. SMS provides an appropriate communication medium because it does not require broadband internet access and can continue supporting basic communication when mobile data services are degraded.

DR2. Human-Bot Interaction for Information Exchange

Affected residents need a simple and reliable way to report outages, request assistance, and receive relevant updates. The chatbot should support conversational SMS interactions by receiving outage reports, confirming submissions, asking follow-up questions when appropriate, and providing concise responses. Because users may experience limited battery life or delayed message delivery, interactions should also support asynchronous communication.

DR3. Location-Aware Community Formation

Disaster-related needs are often localized, and nearby residents are frequently best positioned to provide timely assistance. The artifact should use registration information, user-provided addresses, or approximate location data to identify geographically proximate users affected by the same outage. Based on location, outage relevance, and user consent, the chatbot can facilitate the formation of temporary neighborhood support groups.

DR4. Bot-Mediated Communication

Residents may not know which nearby neighbors require assistance or which individuals can provide resources. The chatbot should act as a communication intermediary by inviting users into temporary communication sessions, managing participation rules, routing messages, and allowing participants to join or leave sessions as needed. This mechanism supports structured neighborhood coordination while reducing the need for users to initially exchange personal contact information.

DR5. Peer-to-Peer Collaboration for Mutual Aid

The artifact should facilitate localized assistance by enabling residents to coordinate the sharing of supplies, charging access, transportation, local information, or other resources. The chatbot is intended to complement—not replace—official emergency response and utility restoration efforts by supporting decentralized neighbor-to-neighbor collaboration during infrastructure disruptions.

DR6. Privacy, Consent, and Safety

Because the artifact may involve location information, personal needs, and communication among nearby residents, participation should be voluntary and based on explicit user consent. Personal information, including exact addresses and phone numbers, should not be disclosed automatically. The artifact should also allow users to leave support groups, report inappropriate behavior, and receive guidance when situations require emergency services.

Collectively, these six design requirements define the primary objective of the proposed conceptual

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artifact: to support accessible, low-bandwidth communication for outage reporting, localized community formation, and peer-to-peer mutual aid during power and internet outages. Together, they operationalize the Activity Theory constructs presented in Figure 1 through the three design mechanisms of *human-bot interaction*, *bot-mediated communication*, and *peer-to-peer collaboration*, which are reflected in the conceptual artifact presented in the following section. By translating these theoretical concepts into actionable design objectives, the proposed artifact aims to enhance digital community resilience when conventional digital communication infrastructures are disrupted.

4. Conceptual Artifact Design

The proposed conceptual artifact is an SMS-based chatbot designed to support communication, coordination, and mutual aid during power and internet outages. The artifact operationalizes the six design requirements (DR1–DR6) through three integrated design mechanisms: human-bot interaction, bot-mediated communication, and peer-to-peer collaboration. Together, these mechanisms enable affected residents to report outages, receive localized information, connect with nearby users, and coordinate assistance through SMS-based communication.

4.1 Information Exchange Model

Figure 2 illustrates the principal information exchanges among users, the chatbot, and temporary neighborhood support groups. The information exchange model primarily addresses DR1 (Low-Bandwidth Accessibility) and DR2 (Human-Bot Interaction for Information Exchange) while establishing the communication foundation for DR3–DR5.

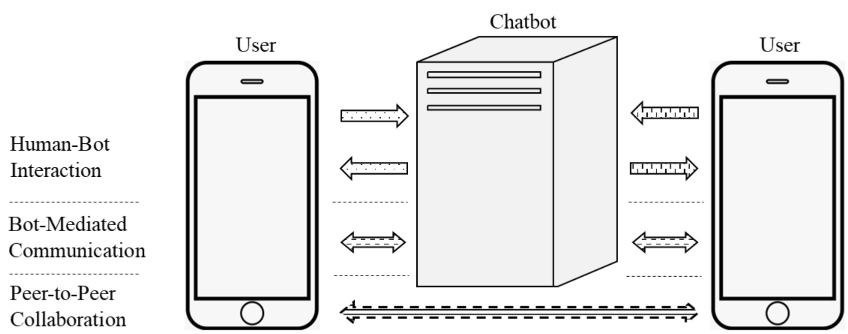

Figure 2. Information Exchanges

Human-bot interaction occurs when an individual resident communicates directly with the chatbot through SMS to report an outage, request assistance, or respond to system prompts. The chatbot confirms reports, requests clarifying information when appropriate, and provides relevant responses based on the user's location and outage status. This interaction supports reliable communication through SMS while accommodating asynchronous messaging under degraded network conditions.

Bot-mediated communication occurs when the chatbot identifies multiple users affected by the same or nearby outage and facilitates the formation of a temporary support group based on geographic proximity and user consent. In this role, the chatbot manages invitations, participation rules, message routing, and session closure. This mechanism addresses DR3 (Location-Aware Community Formation) and DR4 (Bot-Mediated Communication) by enabling structured neighborhood coordination without initially requiring users to exchange personal contact information.

Peer-to-peer collaboration begins once a temporary support group has been established. Participants may coordinate the sharing of supplies, charging access, transportation, local information, or other forms of assistance. The chatbot supports these interactions by maintaining the communication session and clarifying requests, offers, timing, and pickup or delivery arrangements. This mechanism operationalizes DR5 (Peer-to-Peer Collaboration for Mutual Aid).

4.2 System Architecture

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Figure 3 presents the principal components of the proposed conceptual artifact. The architecture consists of household users, an SMS communication channel, a chatbot engine, a central database, an API/gateway layer, and utility or emergency response stakeholders.

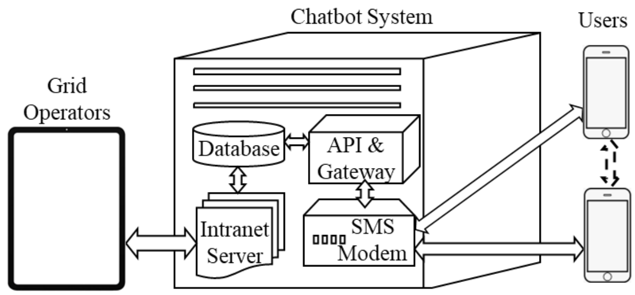

Figure 3. System Architecture

The SMS gateway enables residents to send and receive text messages through a designated telephone number. Because the artifact is intended for situations in which mobile data, Wi-Fi, or web portals may be unavailable, SMS serves as the primary communication channel. Incoming messages are forwarded to the chatbot engine, while outgoing responses are delivered through the same SMS infrastructure, thereby addressing DR1.

The chatbot engine manages the conversational logic of the artifact. It interprets user messages, classifies requests, asks follow-up questions, and determines appropriate responses. For outage reporting, the chatbot collects information such as outage status, approximate location, urgency, and resource needs. For peer assistance, it determines whether the user is requesting help, offering assistance, or participating in an existing neighborhood support session. These functions primarily address DR2, DR3, and DR4.

The central database maintains user profiles, outage reports, approximate location information, temporary support group records, and communication session histories. These data enable the chatbot to identify outage clusters, match nearby users, and maintain continuity across asynchronous SMS conversations.

The API/gateway layer provides optional integration with utility outage management systems, customer service platforms, or emergency communication services. Such integration may enable user-submitted outage reports to supplement utility outage detection while allowing the chatbot to provide restoration updates, safety notifications, or other publicly available information when appropriate.

4.3 Operational Logic

Figure 4 illustrates the operational workflow of the proposed conceptual artifact. The workflow operationalizes the three design mechanisms derived from Activity Theory—human-bot interaction, bot-mediated communication, and peer-to-peer collaboration—to satisfy the six design requirements identified in Section 3.

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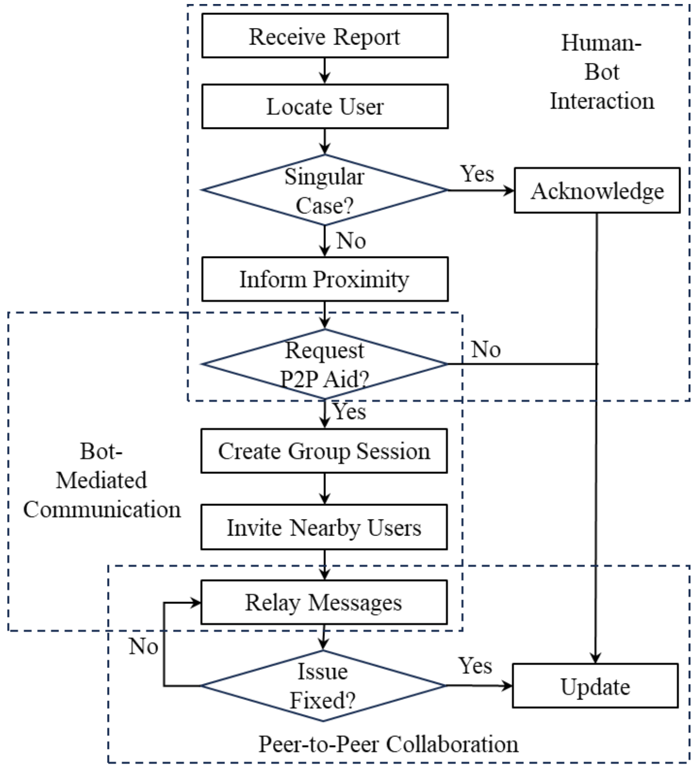

Figure 4. Operational Workflow

The process begins when a resident sends an SMS message to report an outage or request assistance. The chatbot acknowledges receipt and determines whether the issue appears isolated or part of a broader local outage based on user location, nearby reports, utility outage information, or a combination of these sources.

If the outage appears isolated, the chatbot confirms the report and provides available guidance or status information. If multiple nearby users appear to be affected, the chatbot identifies potential participants for a temporary neighborhood support group. Before initiating the group, the chatbot requests explicit user consent to ensure that participation remains voluntary.

Once users consent, the chatbot establishes a temporary support session in which participants may request assistance, offer resources, or exchange local information. Throughout the session, the chatbot manages message routing, maintains participation boundaries, and allows users to join or leave the session as needed. The session concludes when the identified need has been addressed, participants choose to leave, or the outage has been resolved.

4.4 Privacy and Safety Features

Privacy and safety considerations are integrated throughout the conceptual artifact and directly address DR6 (Privacy, Consent, and Safety). Because the artifact facilitates location-aware communication among nearby residents, participation should remain voluntary and based on explicit user consent. Personal information, including exact addresses and telephone numbers, should not be disclosed automatically.

The chatbot should also allow participants to leave support groups, report inappropriate behavior, and receive reminders that the artifact complements—but does not replace—official emergency services or utility restoration efforts.

Overall, the proposed conceptual artifact operationalizes the six design requirements through three

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integrated design mechanisms. By combining low-bandwidth SMS communication, AI-mediated neighborhood coordination, and peer-to-peer collaboration, the artifact is intended to enhance digital community resilience during power and internet outages.

5. Demonstration: Use Case Scenario

A key stage in design science research is demonstrating how a proposed artifact addresses the identified problem (Peffers et al., 2007). Accordingly, this section presents a use case scenario involving residents affected by a widespread power and internet outage. As illustrated in Figure 5, the scenario demonstrates how the proposed conceptual artifact operationalizes the three design mechanisms—human-bot interaction, bot-mediated communication, and peer-to-peer collaboration—to satisfy the design requirements identified in Section 3 under constrained communication conditions.

The scenario takes place in a neighborhood experiencing a widespread outage following a severe weather event. Electricity is unavailable, home internet service is down, and mobile data connectivity is degraded. Although residents cannot reliably access internet-based applications, SMS messaging remains available. This environment reflects the intended operating context of the proposed conceptual artifact, where affected residents require localized information and community support despite limited communication infrastructure.

The interaction begins when User A sends an SMS message to the chatbot to report a power outage. The chatbot acknowledges the report, confirms the user's approximate location, and determines whether similar outage reports have been submitted nearby. Based on location information and nearby reports, the chatbot determines that the outage is not isolated and asks User A whether they would like to join a temporary neighborhood support session with other affected residents. This interaction demonstrates DR1 (Low-Bandwidth Accessibility) through SMS communication and DR2 (Human-Bot Interaction for Information Exchange) by enabling the user to report the outage, receive confirmation, and respond to chatbot prompts.

After User A provides consent, the chatbot identifies nearby users who have reported similar outage conditions or previously indicated a willingness to provide assistance. User B joins the temporary support session and indicates that extra candles are available. The chatbot relays this information to User A and facilitates clarification regarding the quantity available, preferred pickup or delivery method, and approximate timing. This interaction demonstrates DR3 (Location-Aware Community Formation) and DR4 (Bot-Mediated Communication) by matching nearby residents and managing structured communication among individuals who may not previously know one another.

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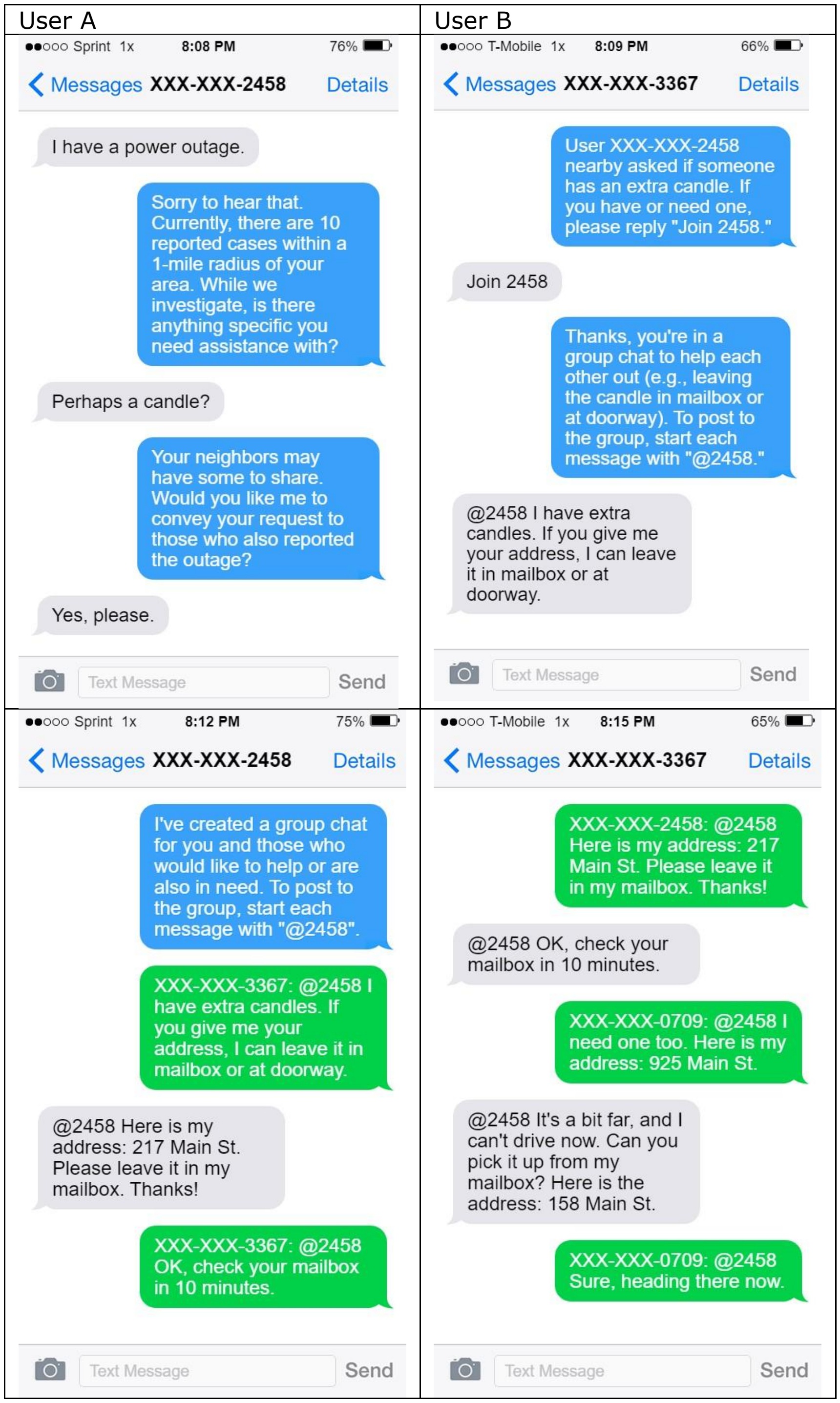

Figure 5. Exemplary SMS-Based Chatbot Interaction

The interaction then progresses into peer-to-peer collaboration. User A requests that the candles be left in a mailbox, and User B agrees. User C later joins the session and also requests a candle. User B explains that assistance is available if User C can collect the item. Throughout this exchange, the chatbot maintains the communication session while residents coordinate localized mutual aid. This interaction demonstrates DR5 (Peer-to-Peer Collaboration for Mutual Aid) while complementing ongoing utility

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restoration and emergency response efforts.

This use case demonstrates how the proposed conceptual artifact addresses the six design requirements identified in Section 3. SMS messaging provides resilient, low-bandwidth communication (DR1), while conversational interactions support outage reporting and information exchange (DR2). Geographic matching enables temporary neighborhood support groups (DR3), the chatbot facilitates structured communication among participants (DR4), and residents coordinate localized assistance through peer-to-peer collaboration (DR5). Throughout the scenario, participation remains voluntary, illustrating the privacy, consent, and safety principles defined in DR6.

The scenario also demonstrates how the conceptual artifact operationalizes the Activity Theory framework presented in Figure 1. The affected resident serves as the subject, the outage-related need represents the object, and the chatbot functions as the mediating tool that facilitates communication and coordination. Nearby residents, utility providers, and emergency responders constitute the broader community, while consent policies and communication procedures represent the governing rules. The division of labor emerges as participants assume complementary roles, such as resource seeker, resource provider, and coordinator. Through these interactions, the proposed conceptual artifact transforms isolated outage experiences into coordinated community response.

6. Proposed Evaluation Framework and Implementation Considerations

Evaluation is a fundamental stage of Design Science Research because it determines whether a proposed artifact addresses the problem it was designed to solve (Hevner et al., 2004; Peffers et al., 2007). As this study presents the SMS-based chatbot as a conceptual artifact, evaluation remains a direction for future research. This section outlines a proposed evaluation framework that can be used to assess the artifact's ability to satisfy the six design requirements (DR1–DR6) while also discussing considerations for future implementation.

6.1 Proposed Evaluation Framework

The first evaluation approach is scenario-based evaluation. The use-case scenario presented in Section 5 provides an initial demonstration of how the conceptual artifact addresses the identified design requirements. Future evaluations can assess whether the proposed design adequately supports low-bandwidth accessibility (DR1), human-bot interaction (DR2), location-aware community formation (DR3), bot-mediated communication (DR4), peer-to-peer collaboration (DR5), and privacy, consent, and safety (DR6). This approach is appropriate during the conceptual design stage because it examines the logical consistency between the identified problem, the design requirements, and the proposed artifact.

The second evaluation approach is expert review. Subject matter experts in information systems, emergency management, utility operations, cybersecurity, and human-computer interaction could evaluate the conceptual design for technical feasibility, operational value, and ethical appropriateness. Expert feedback could identify opportunities to improve consent procedures, privacy protections, message routing, misinformation management, or integration with existing utility outage management systems before prototype development.

The third evaluation approach is technical feasibility assessment. Following prototype implementation, evaluation could examine message delivery success, response latency, system availability, location-based matching accuracy, and support for asynchronous SMS communication. These measures would help determine whether the artifact can reliably operate when internet-based communication channels are unavailable or unreliable.

The fourth evaluation approach is user-centered evaluation. Prospective users could complete simulated outage scenarios involving outage reporting, assistance requests, temporary neighborhood support groups, and resource coordination. User feedback could then be collected to assess perceived usefulness, ease of use, trust, safety perceptions, and willingness to use the artifact during an actual outage.

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To summarize the proposed evaluation strategy, Table 2 maps each evaluation approach to its primary objective and the design requirements (DR1–DR6) it is intended to assess. Collectively, these complementary approaches provide a structured framework for evaluating the conceptual artifact as it progresses from conceptual design to prototype development and user validation.

Table 2. Proposed Evaluation Framework

Evaluation Approach	Evaluation Objective	DRs Assessed
Scenario-Based Evaluation	Assess whether the conceptual artifact logically addresses the identified problem and satisfies the proposed design requirements through representative outage scenarios.	DR1–DR6
Expert Review	Evaluate the conceptual design for technical feasibility, operational value, privacy, ethics, and integration with existing utility and emergency management practices.	DR2–DR6
Prototype Evaluation	Assess the performance of a future prototype, including SMS delivery, response latency, location-aware matching, system availability, and asynchronous communication.	DR1–DR4
User-Centered Evaluation	Evaluate usability, perceived usefulness, trust, willingness to use the artifact, and user satisfaction through simulated outage scenarios.	DR1–DR6

6.2 Implementation Considerations

Future implementation of the proposed conceptual artifact would require collaboration among utility companies, emergency management organizations, local governments, and community stakeholders. Utility companies represent particularly appropriate implementation partners because they already maintain customer communication systems, outage reporting platforms, and restoration workflows. The proposed chatbot could complement these existing capabilities by providing a resilient, low-bandwidth communication channel while facilitating localized peer assistance during infrastructure disruptions.

Implementation planning should occur before disaster events. During the planning phase, implementing organizations should identify communication gaps, outage-prone areas, vulnerable populations, and community expectations. During system development, the chatbot should be configured to reflect local conditions, including population density, neighborhood geography, language preferences, and accessibility requirements. Prior to deployment, public awareness efforts—including utility bills, websites, email communications, social media, and community outreach—should familiarize residents with the SMS service. Following deployment, outage data and user feedback should be reviewed to refine message templates, neighborhood matching rules, privacy protections, and integration with utility systems.

Privacy, safety, and ethical considerations should remain central throughout implementation. Participation in neighborhood support sessions should always require explicit user consent. Personal information, including exact addresses and telephone numbers, should not be disclosed automatically. Users should be able to leave support groups, report inappropriate behavior, and receive reminders that the chatbot complements—but does not replace—911, emergency medical services, or official utility restoration efforts. When users report immediate danger, medical emergencies, fires, downed power lines, or other life-threatening situations, the chatbot should direct them to the appropriate emergency services.

Implementation should also consider the needs of vulnerable populations, including older adults, individuals with disabilities, residents with limited English proficiency, and those with limited access to digital technologies. Multilingual support, accessible interaction design, and simple SMS-based communication procedures can help ensure that the proposed artifact strengthens digital community resilience equitably across diverse communities.

Overall, the proposed evaluation framework and implementation considerations provide a roadmap for

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advancing the conceptual artifact toward future prototype development, empirical evaluation, and practical deployment. Together, they extend the Design Science Research process beyond conceptual design by identifying how the artifact can be systematically assessed and refined in subsequent research.

7. Discussion and Implications

The proposed conceptual artifact illustrates how information systems can support digital community resilience during infrastructure disruptions. Unlike internet-dependent communication platforms, the artifact leverages SMS to support outage reporting, localized information exchange, and peer-to-peer mutual aid when conventional communication channels are unavailable.

From a Design Science Research perspective, this study addresses a socially significant problem through the conceptual design of an information systems artifact. By integrating SMS communication, conversational AI, location-aware neighborhood grouping, consent-based participation, and peer-to-peer coordination, the artifact operationalizes the six design requirements identified in this study and provides a foundation for future prototype development and evaluation.

This study contributes to digital resilience research by extending the discussion to the community level. While prior research has emphasized organizations, critical infrastructures, and institutional continuity, the proposed artifact demonstrates how low-bandwidth technologies can strengthen communication and collaboration among residents during infrastructure disruptions. Grounded in Activity Theory, the chatbot functions as a mediating tool that supports individual action while facilitating collective neighborhood response through temporary support groups and shared problem-solving.

The study also has practical implications for utility companies, emergency management agencies, local governments, and community organizations. The proposed artifact could complement existing outage management and emergency communication systems by providing a resilient, low-bandwidth channel that supports localized coordination and mutual aid while official response efforts continue.

Future implementation should emphasize user trust through clear privacy protections, transparent consent procedures, and collaboration with trusted organizations. This study is limited by its conceptual design and illustrative use-case demonstration, and future research should develop a working prototype and conduct expert, user-centered, and field evaluations to assess technical performance, usability, privacy, accessibility, and scalability across diverse disaster contexts.

8. Conclusion

Power and internet outages during disasters create significant communication challenges for affected communities. When internet-based platforms become unavailable, residents may struggle to obtain information, report local conditions, and coordinate assistance. This study addresses this problem by proposing the conceptual design of an SMS-based chatbot artifact to enhance digital community resilience during infrastructure disruptions.

Using a Design Science Research approach, the study identifies six design requirements (DR1–DR6) and proposes a conceptual artifact that operationalizes them through three integrated design mechanisms: human-bot interaction, bot-mediated communication, and peer-to-peer collaboration. Grounded in Activity Theory, the artifact leverages SMS to support outage reporting, neighborhood coordination, and localized mutual aid when internet-dependent communication is unavailable.

This study contributes to information systems research in three ways. First, it extends digital resilience research by focusing on community-level resilience during infrastructure disruptions. Second, it identifies design requirements to guide the future development of SMS-based community resilience systems. Third, it contributes to Design Science Research by proposing a theoretically grounded conceptual artifact that provides a foundation for future prototype development and empirical evaluation.

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From a practical perspective, the proposed artifact offers utility companies, emergency management agencies, local governments, and community organizations a potential approach for strengthening communication and neighborhood coordination during infrastructure disruptions. Future research should develop and evaluate a working prototype through expert, prototype, user-centered, and field evaluations across diverse disaster contexts.

More broadly, this research demonstrates how low-bandwidth, AI-mediated communication technologies can complement existing emergency communication infrastructures by strengthening neighborhood-level coordination and mutual aid during infrastructure disruptions.

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ISSN: 2473-4901
v12 n6689

ISSN: 2473-4901
v12 n6689

APPENDIX

Table A1. Existing Communication Approaches vs. Proposed Conceptual Artifact

Capability	**Utility SMS Systems**	**Internet-Based Community Platforms**	**Proposed Conceptual Artifact**
Operates during internet outages	✓ Uses SMS	✗ Requires internet connectivity	✓ Uses SMS for low-bandwidth communication
Outage reporting	✓ Customer-to-utility reporting	Limited or informal	✓ Conversational outage reporting through AI chatbot
Restoration status updates	✓ Utility notifications	✗ Not a primary function	✓ Chatbot provides outage information when available
Neighbor-to-neighbor communication	✗ Not supported	✓ General community messaging	✓ AI-mediated neighborhood communication
Temporary support group formation	✗ Not supported	Limited (manual user organization)	✓ Automated, consent-based neighborhood support groups
Location-aware coordination	Limited (customer address only)	Limited (user-managed groups)	✓ Location-based matching of nearby residents
AI-assisted interaction	✗ Not supported	Limited (platform dependent)	✓ Conversational AI assistance
Mutual aid coordination	✗ Not supported	Informal user coordination	✓ Structured peer-to-peer resource sharing and assistance
Privacy through controlled participant matching	✗ Not designed for this purpose	Limited; users self-disclose information	✓ Consent-based participation with controlled neighborhood matching
Primary design objective	Utility service communication	Social networking and community interaction	Digital community resilience during infrastructure disruptions

Note. Internet-based community platforms include applications such as *Nextdoor*, *WhatsApp*, and *Facebook Groups*, which facilitate community interaction but generally depend on internet connectivity. Utility SMS systems represent the SMS-based outage reporting and notification services commonly provided by electric utilities. The proposed conceptual artifact is based on the design presented in this study. The comparison is synthesized from the crisis informatics and digital resilience literature (Palen & Vieweg, 2008; Reuter & Kaufhold, 2018; Tim & Leidner, 2023; Li et al., 2025).